American Machinist

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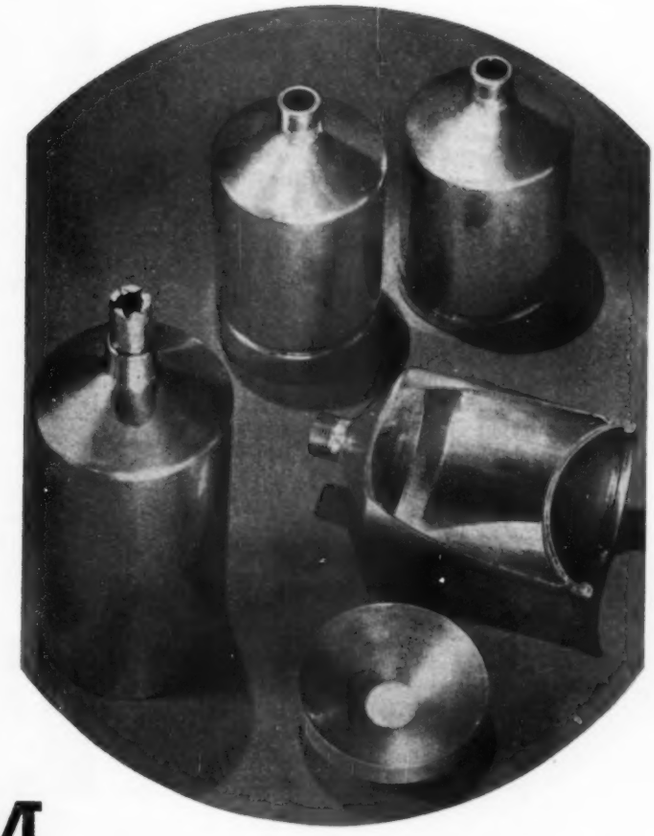
HALL made aluminum a commercial possibility only 50 years ago, but its developments have outrun common knowledge of fabricating the metal and its many alloys



Impact extrusion lends itself to containers of many kinds. Recent advances in technique and in tool steels have made possible shapes that were out of the question a few years back

ALUMINUM 1936 PRACTICE

F. V. HARTMAN

Aluminum Company of America

MOST of us make daily use of aluminum articles without thinking how new the material really is. But there are men still alive and active who took part in the early commercialization of the metal. They can tell of their struggles to roll sheet and to draw wire. And they can also tell that established industries working other metals did not care to take on the new material and so the development program had to be carried on alone. The lesson learned from these early struggles has not been forgotten, and the industry has vigorously pursued a research program down to the present time. So fast has knowledge accumulated, particularly recently, that it is doubtful the information has been properly disseminated and absorbed by private fabricators. In fact, many shops have not had to work aluminum at all. But the world is becoming more conscious of the advantages of light-weight construction, and it is to be expected that shop men will have increasing use for the latest fabricating information in 1936.

"Aluminum" is a good generic name for the many alloys we are called upon to work, but only by being specific can confusion and bad practice be avoided. These alloys are classed principally as heat-treatable and non-heat-treatable. The first class can be produced in various tempers only by cold rolling, drawing or hammering.

Heat-treatment of certain alloys produces decided improvement in tensile and yield strengths and in hardness. These gains are accompanied in some instances with remarkable retention of ductility. It should be remembered, however, that the change in properties is hardly comparable to that produced in steel.

Briefly, heat-treatment is accomplished by heating the metal at a temperature of about 950 F. and then quenching in water. The exact temperature differs somewhat for the different alloys. This is followed by an aging process. Aging occurs spontaneously at room temperature for some

of the alloys, while other alloys have to be aged "artificially" by heating the metal to a temperature of about 300 F. for a period of time. The metal is considerably more ductile before aging and advantage is taken of this fact when difficult forming operations are involved. The alloys which do not age spontaneously may be used without aging; they are, however, generally aged because only by this treatment do they attain their full strength and hardness.

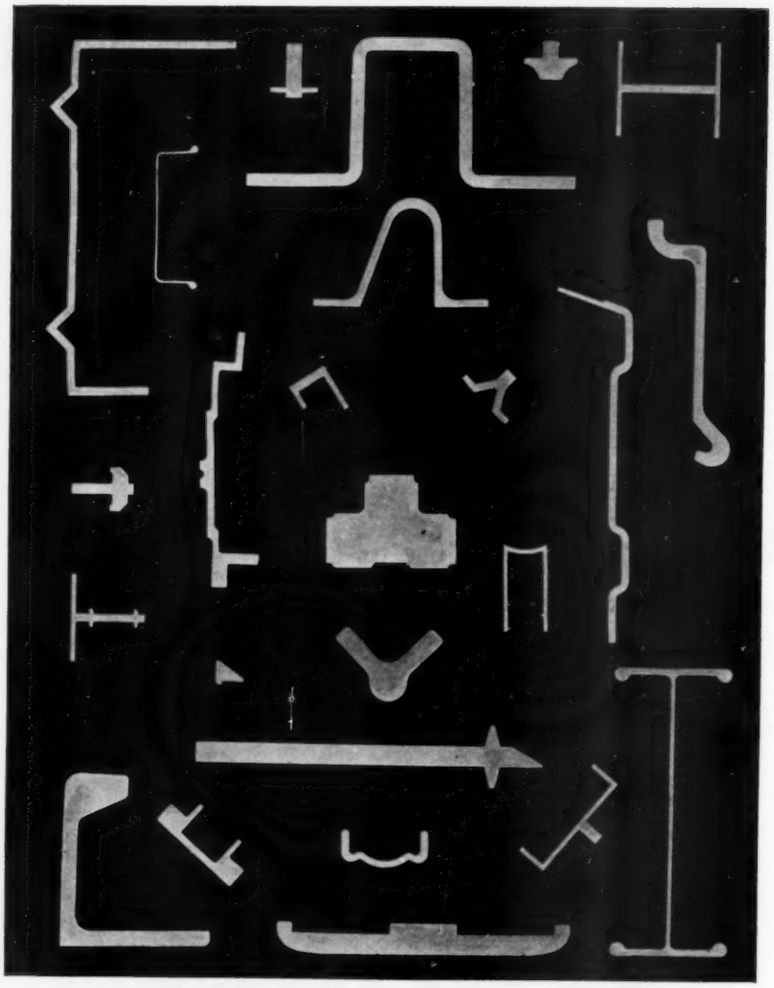
Forming of Aluminum

Aluminum may be readily formed. Some of the earliest uses of the metal were for novelties of various kinds that were generally drawn, spun, or hammered from sheet. The manufacture of aluminum cooking utensils soon followed, an application which required until recently a major percentage of the output of the metal. Even today, many are still inclined to think of aluminum as only a cooking utensil metal, and it is not surprising that some still find it difficult to realize the position that this metal in the alloyed form has taken.

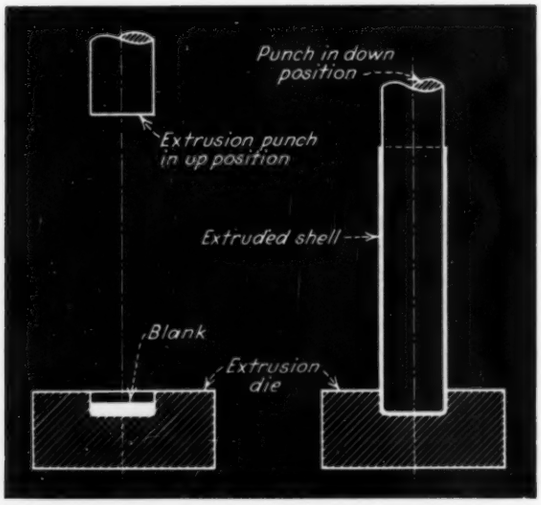
The forming of aluminum and its alloys does not differ in principle from that of other metals. Aluminum may be hammered, bumped, pressed, drawn or spun. It may be bent on the cornice brake and sections made from strip sheet may be formed on cold-roll forming machines or by drawing the strip through a series of dies.

The coefficient of friction between aluminum and the metals generally used for forming tools is higher than in the case of some of the other sheet metals. It is, therefore, important to use a good lubricant for many forming operations. For simple drawing operations, a light mineral oil may be used, but for deep drawing an oil with considerable body is necessary. Mutton tallow is an effective lubricant for difficult drawing operations. Because of the softness of aluminum, reasonable care should be exercised to avoid scratching. This characteristic, together with the higher coefficient of friction, makes it desirable that drawing tool surfaces have a smooth finish.

Aluminum hardens considerably when hammered. Wood or soft-faced hammers of fiber or rubber should be used instead of hard metal hammers. Many aircraft parts are formed by hammering with soft hammers over wooden forms, when the quantity does not justify higher production tools. Here, the soft tools are used not only because of the greater amount of forming possible, but because hard tools are more likely to cause injuries to the sur-



Extruded shapes are an economical means of securing stock for product parts as well as for structural and finishing members in architectural, railroad car and bus construction



Only a shallow die is required for impact extrusion of aluminum. Heavy pressure on the punch causes this metal to flow up around it, the clearance between the punch and die determining the wall thickness of the tube

face which might lead to fatigue failure of metal in continued service.

When aluminum is hardened from cold work it becomes "springy" like most other metals. The "spring back" for aluminum, however, is more, and greater allowance must be made in tools for forming aluminum. The allowance depends on the operation and how it is performed.

Any of the tool materials used for drawing other metals may be used for aluminum and its alloys. Heat-treated alloy steels may be the answer for quantity production, but cast iron or mild steel is satisfactory for many jobs. A metal punch and rubber die are often employed for some of the forming and embossing operations. Selection of the tool material is mostly a function of the kind of forming operation and the quantity to be formed. While it may sometimes be influenced by the aluminum alloy and its temper, the selection is not necessarily peculiar to aluminum.

For the spinning of aluminum, chucks of hardwood are widely used, especially for small quantity production. Iron or steel chucks are generally necessary for complicated re-entrant forms, where the chucks have to be made in sections which can be withdrawn piece by piece from the completed spinning. In some instances, re-entrant forms may be spun without a chuck, and in such cases, the tools are manipulated in much the same manner as when a potter molds clay.

Light gages up to about ⅛ in. thick are spun by hand-operated tools of hardwood, generally a hickory stick. Heavy work requires power-operated tools of steel. Metal up to 1 in. thick has been spun successfully.

The peripheral speed for spinning depends upon the blank diameter, its thickness, the composition of the metal, and the contour of the shell to be formed. Speeds of 2,000 to 5,000 ft. per min. are quite general.

Lubrication is essential in spinning. Beeswax, tallow or lard oil mixed with white lead or vaseline are quite suitable for small work. Where a considerable pressure is necessary, as in spinning large ware, these lubricants are not satisfactory. Kitchen soap, of the yellow household variety, has been used with success in these operations.

While it is true that most of the alloys are harder to form than the commercially pure metal, an examination of one of our modern airlines indictates the strides that have been made in forming the strong alloys of aluminum. Here, the engine cowling, the wing and fuselage structure, and many other parts are all formed of high-strength aluminum alloys. Only a few years ago, many of these parts would have been considered none too simple to form.

In some cases, it may be necessary to form the metal in the annealed condition and then heat-treat the formed article, particularly where the forming operations are extremely difficult. This practice, for instance, has been employed in the manufacture of aluminum-alloy artificial limbs.

Extruded Aluminum Shapes

Aluminum and most of its alloys may be extruded readily. By this process, a heated ingot or billet of aluminum or aluminum alloy is placed in a cylinder and forced out through a die by means of a ram or plunger. The contour of the die opening determines the shape of the finished section. The process lends itself to many forms. It was first adopted for simple shapes such as round, square and hex bar, and odd-shaped molding. Early developments were limited to the softer alloys and commercially pure aluminum, but now most of the strong alloys of aluminum may be extruded because of the improvements in alloy manufacture and in the technique of extrusion. Complicated sections that were considered impossible only a few years ago are now common in production.

One of the wide uses of extruded aluminum sections is in special shaped members for architectural trim. Some of these shapes are used largely for ornamental effects, while others are both ornamental and structural.

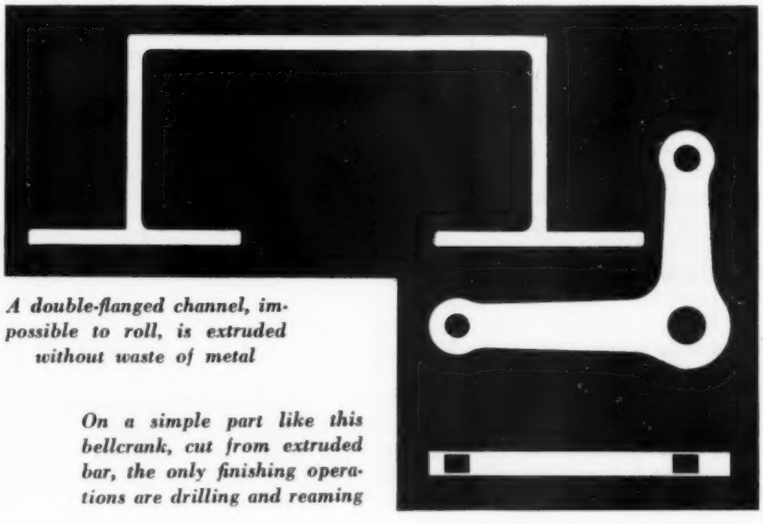
The modern light-weight aluminum railroad car is a typical example of the uses of extruded aluminum sections. Many of the structural members are shapes that can be produced only by extrusion and they are fabricated in lengths up to about 80 ft., thus permitting a new kind of construction not possible with ordinary structural shapes. Other sections are so shaped that they serve both as structural members and as outside trim finish.

An outstanding advantage of the extrusion process is that it makes possible the economical production of structural shapes having a more efficient distribution of material; the process does not impose the restrictions on economical metal distribution as is the case for the rolling process. Extrusion permits the use of extra metal at the ends of the flanges of the channel and I-sections; the usual tapering of thickness at the ends is not necessary. This extra metal, generally called a bulb, stiffens the outer edge.

Impact Extrusion

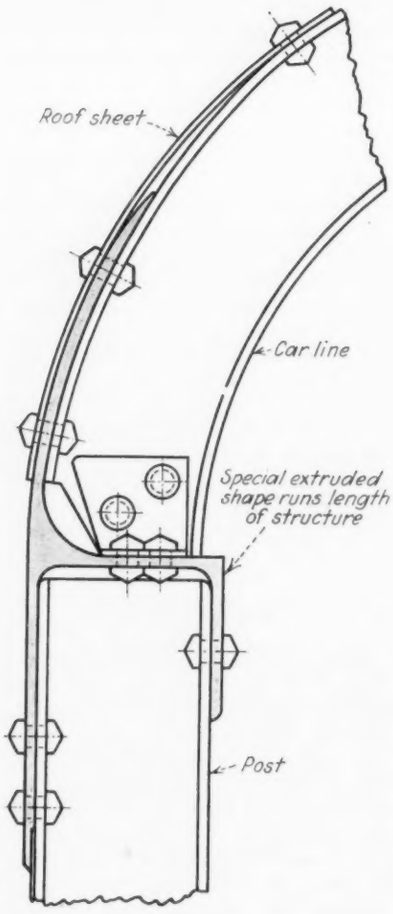
Impact extrusion is a process for the economical production of certain types of cans that are impossible or impractical to manufacture by other methods. By this process, a small thick disk or slug of metal is inserted in a shallow hole in the die and then struck by the punch. The pressure of the punch compresses the metal sufficiently to cause it to flow out of the die through the annular space between the punch and the die; the clearance determines the wall thickness of the can. The bottom of the can is formed of the material left in the bottom of the die.

This process requires a heavy-duty power press and extra strong steel for the tools, because the force required to extrude the metal is extremely high.



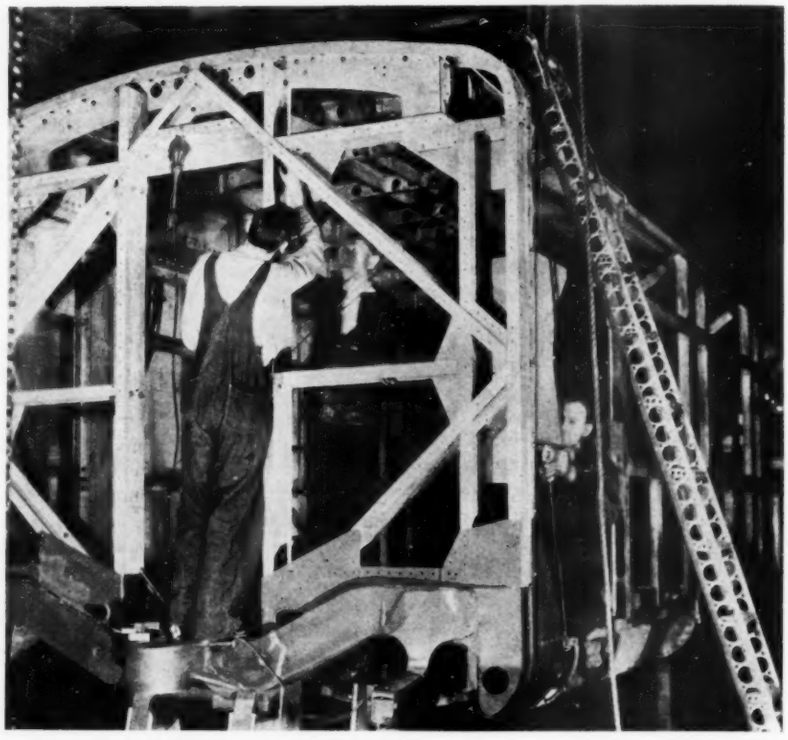
A double-flanged channel, impossible to roll, is extruded without waste of metal

On a simple part like this bellcrank, cut from extruded bar, the only finishing operations are drilling and reaming



Extruded shapes can be made in lengths up to 80 ft., which makes possible new and valuable features in car construction. Here a special shape functions as both a structural and a finish member

Formed aluminum sections speed assembly of a subway car and will afford further savings in use through lowered operating charges



In fact, the process is hydraulic in principle, as the metal behaves in practically the same manner as a fluid with a high surface tension and internal frictional resistance.

Impact extrusion is especially suited for deep cans with thin walls and thick bottoms. It is economical for cans that are deeper than about 1.5 times the diameter because only one operation is required, whereas a can of similar proportions drawn from sheet may require a number of drawing operations. For flat bottom cans, the minimum practical wall thickness is approximately 1/100 of the diameter of the can. Small cans with conical bottoms may be made with walls appreciably thinner than this amount, down to a minimum of about 0.003 in.

The diameter and length of can that may be produced is limited largely by the press equipment and the shape of the bottom. A rough idea of the size obtainable is indicated by the fact that flat bottom cans 4 in. in diameter by about 10 in. deep, have been produced. The process may be used for round, oval, rectangular and odd shaped containers, and the side walls may be made with longitudinal ribs. Bottoms may be quite thick and may have bosses or lugs on the inside or outside.

Impact extrusion lends itself not only to the manufacture of hollow parts but also solid parts. There are any number of these parts, consisting essentially of a flange or head with a long stem.

Aluminum Forgings

Advanced forging developments have provided industry with aluminum alloy forgings that are strong, light and economical. Some of the strongest heat-treated alloys may be supplied as forgings. They offer greater uniformity of properties and high shock-resisting qualities. The metal in a forging may be distributed much more economically than is possible with castings and, in most instances, forgings may be furnished to the finished size, thus eliminating considerable machining expense. Aluminum alloy forgings are, therefore, replacing sand castings for many kinds of brackets, fittings and flanged bosses.

Welding

Less than 25 years ago, the welding of aluminum was not very well understood and most of the joining was by riveting. Tanks, kettles and containers too large to be formed from one plate (and the plates were not very large) had to be assembled by riveting. Large containers were unsightly with the many rivet heads where dirt would gather and where leaks were likely to occur if the vessels carried pressure. The present product is more sanitary and indicates a construction that is required in equipment used for the preparation of foods, including dairy and brewery equipment. Welded construction has enabled aluminum to be used for many types of tanks, vats, condensers, coolers and pressure vessels in the chemical industry, where the construction would be difficult and not serviceable if riveted construction had to be employed.

For the kinds of construction just mentioned, gas welding is employed, and either oxyacetylene or oxyhydro-

gen gas may be used. It is important that the flame be neutral. A suitable welding flux is also necessary because aluminum and its alloys are covered with a refractory oxide film that prevents coalescence of the molten metal unless a flux is used to float off the film. In practice, such fluxes are applied by sprinkling the powdered flux on the weld or by dipping the welding wire in a paste made of the powder and water.

The attainment of sound welds and neat, speedy work is dependent upon the proper preparation of the parts to be welded. Sound welds can be produced in all of the aluminum alloys, but in practice, welding is employed mostly for commercially pure aluminum, the non-heat-treatable alloys and one or two of the heat-treated alloys. Some of the casting alloys are also welded. The choice of weld filler wire is determined by the alloy to be welded. Commercially pure aluminum wire is used for the more simple non-heat-treatable alloys, and an aluminum alloy wire containing 5 per cent silicon is generally used for the higher strength non-heat-treatable alloys and also for the heat-treated alloys. Aluminum castings are sometimes welded with the aluminum-silicon alloy wire, but in many instances a wire of the same composition as the casting is used.

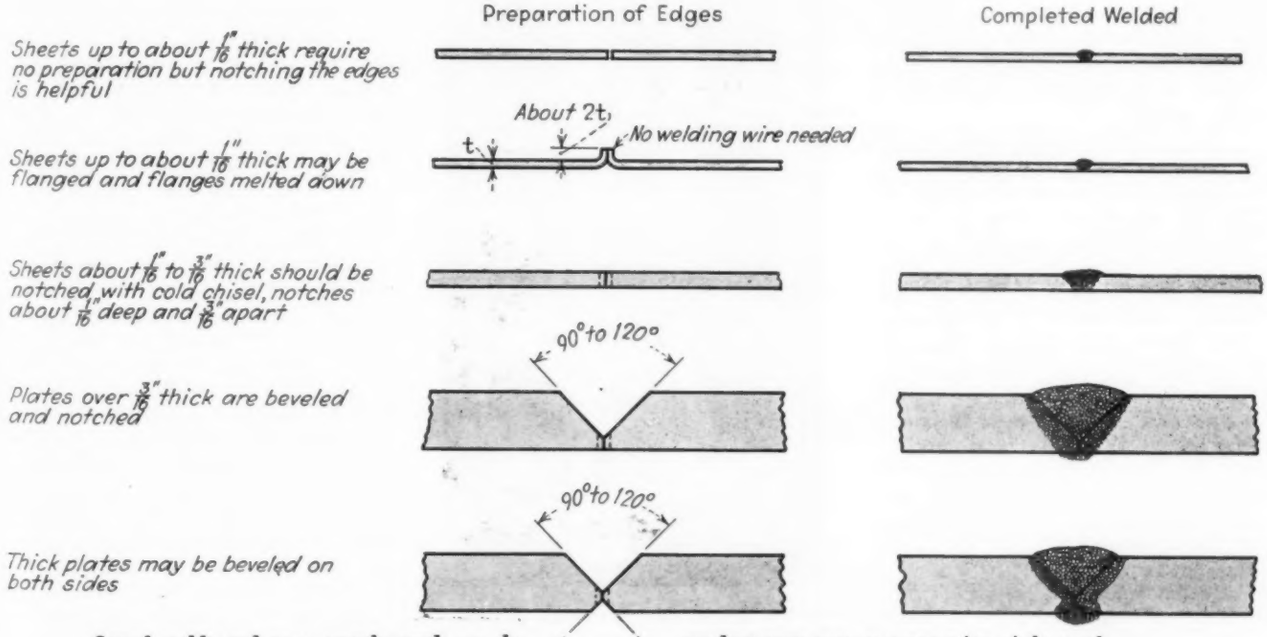
Metallic arc welding is frequently employed for aluminum parts. This method of welding is of advantage in limiting the annealing effect of the welding heat to a narrow zone on each side of the weld. In addition, the amount of distortion caused by thermal expansion in the welded parts is substantially decreased. These characteristics make the process especially adaptable for attaching stiffeners to large flat sheet areas.

The standard motor generator sets commonly used for welding steel are satisfactory for the metallic arc welding of aluminum. Welding rods are generally an aluminum alloy containing 5 per cent silicon, coated heavily with welding flux. The flux serves the double purpose of removing the oxide film on the parent metal and in stabilizing the arc. In welding, a short arc is held in order to minimize spatter of the molten metal and flux over the work. The constituents of the flux coatings are hygroscopic to a limited extent, and the rods must be stored in a dry place. It is advisable to dry rods that have been stored for long periods on a radiator or by placing on or near a furnace.

Material 0.081 in. thick and heavier can easily be butt welded in the shop; lighter sheet is difficult to weld commercially because the high temperature of the arc and the rapid melting rate of the rod make the process difficult to control. On material up to ¼ in. thick, no preparation of the edges is necessary when butt welding. For heavier material, when the welding must be done from one side, the edges are beveled to within ⅛ in. of the sheet thickness. If the welding can be done from both sides of the sheet, no preliminary beveling is required on material up to ½ in. thick.

Owing to the fluidity of the molten metal when welding by the metallic arc process, it is important to provide adequate support for the weld metal on the back side of the sheets to be welded. Where possible, when making butt welds, the sheets should be placed horizontally to permit using

When beer came back the metal barrel came in. A heat-treatable strong alloy resists the shocks of service, is readily drawn to shape and welded


Preparation of Edges
Completed Welded
Sheets up to about 1/16" thick require no preparation but notching the edges is helpful
About 2t
t
No welding wire needed
Sheets up to about 1/16" thick may be flanged and flanges melted down
Sheets about 1/16" to 3/16" thick should be notched with cold chisel, notches about 1/16" deep and 3/16" apart
90° to 120°
Plates over 3/16" thick are beveled and notched
90° to 120°
Thick plates may be beveled on both sides
90° to 120°

Sound welds and neat, speedy work are dependent upon proper preparation of the work. The metal is always coated with a refractory oxide and flux must always be used

back-up strips under the weld. These are of steel or copper and are made with a groove about $\frac{1}{8}$ in. deep by $\frac{3}{8}$ in. wide; the groove is held directly beneath the weld to provide space for the formation of the weld penetration bead.

It is important that the welding flux be removed from both gas and metallic arc welds after the welds have been made because the constituents of all aluminum welding fluxes in contact with moisture from the atmosphere or other sources will in time cause corrosion. The cleaning can be done in boiling water, if it is done as soon after welding as the parts cool sufficiently to permit handling. The flux on metallic-arc welds adheres more tenaciously and requires vigorous action with a wire brush to remove it. Flux on the inside of tanks and other inaccessible areas can be removed by immersing the part in a hot solution of 10 per cent sulphuric or nitric acid for one-half hour.

The thoroughness of the cleaning job can be ascertained by the application of a few drops of 2 per cent silver nitrate solution. The formation of a white cloudy precipitate indicates that flux is still present and further cleaning should be done. The solution will remain colorless if no flux is present.

Spot Welding

Spot and seam welding equipment and processes have developed to such a point that a number of commercial applications have been made that are operating successfully. Past work has established certain facts which are outlined below. These are of particular interest when contemplating the assembly of an aluminum job by spot or seam welding.

Successful commercial fabrication of the aluminum alloys by spot and seam welding requires proper equipment and suitable supervision. With few exceptions, equipment as designed and used for spot welding other metals is unsatisfactory for use with the aluminum alloys. A tabulation of the characteristics required for suitable aluminum alloy work will tend to emphasize the reason for this condition.

Spot and seam welding of the aluminum alloys is essentially a precision job, but, if the equipment provides the following features, consistent and high-class results can be obtained with any of the aluminum alloys. These features are:

1. Suitable electrode design.
2. A proper value of welding current for the work in question.
3. Precision synchronous timing for the highest quality strong alloy work, or reasonably accurate non-synchronous timing for certain jobs using common alloys.
4. A quickly adjustable and accurate electrode pressure mechanism.
5. A design of machine to minimize electrode hammer-blow.
6. Equipment to insure that the adjustments as made are maintained for successive, duplicate welds.

It is easy to install any desired type of electrode on a spot welder. The majority of machines used in welding steel provide fairly suitable pressure mechanism, although in some cases it is not always convenient to adjust them for welding aluminum and their value is indeterminate.

The other features—sufficient current, proper timing, and low electrode inertia—are in most cases absent to a greater or lesser degree in commercial spot welders for welding steel.

For these reasons, best results are obtainable only with equipment especially designed to provide the desired features. Most of the major welding machine manufacturers are familiar with these requirements and can supply equipment meeting any desired aluminum spot or seam welding application.

Spot welds replace rivets in this aluminum frame, adding to the appearance and speeding up assembly

Seam welding is merely a special application of spot welding, and all of the previously mentioned machine requirements must be complied with to obtain satisfactory results, with the exception that low electrode inertia is not important.

Electronic control is the only known practical method for providing the necessary intermittent power supply. By changing the timing and electrode roller speed, an intermittent seam weld may be made giving the same results as if done with a spot welder, but permitting a much higher rate of production.

An application of spot welding has been to replace rivets in a frame built of extruded sections, principally angles. The result was a sturdy frame of simple construction without rivet heads to interfere with the mounting of the panel sheets. It is true that countersunk rivets could have been used but these heads are difficult to drive satisfactorily.

Spot and seam welding may be employed for the non-heat-treatable aluminum alloys and for most of the heat-treated alloys. Thus, the application of the electric resistance method of welding may be extended to any number of aluminum parts and structures.

Machining Aluminum

Aluminum has machining characteristics that are peculiar to the metal and most of its alloys. The cutting characteristics differ from those of steel and especially from those of brass. For instance, brass is machined best with a rather blunt cutting tool. A somewhat keener-edged tool is better for cutting steel. While in most instances satisfactory results may be achieved by using steel cutting tools for machining aluminum, the best results will be obtained if the tools are provided with considerably keener cutting edges than those for cutting steel. In fact, aluminum cutting tools are in many respects more nearly like woodworking tools than metal-cutting tools.

The planer or shaper tool shown illustrates the best practice in cutting tool design. As will be noted, the tool, especially for finishing cuts, is provided with considerable top rake or "hook," and also a large side rake angle. With these two angles so large, the tool might well be described by comparing it with the plow; it is shaped to get under the chip and to turn it over to one side. It should be emphasized that such a tool cannot

operate satisfactorily in a badly worn machine tool where the tool post, spindle bearings, and ways are loose. The degree to which these cutting angles can be employed may, therefore, depend upon the condition of the machine tool.

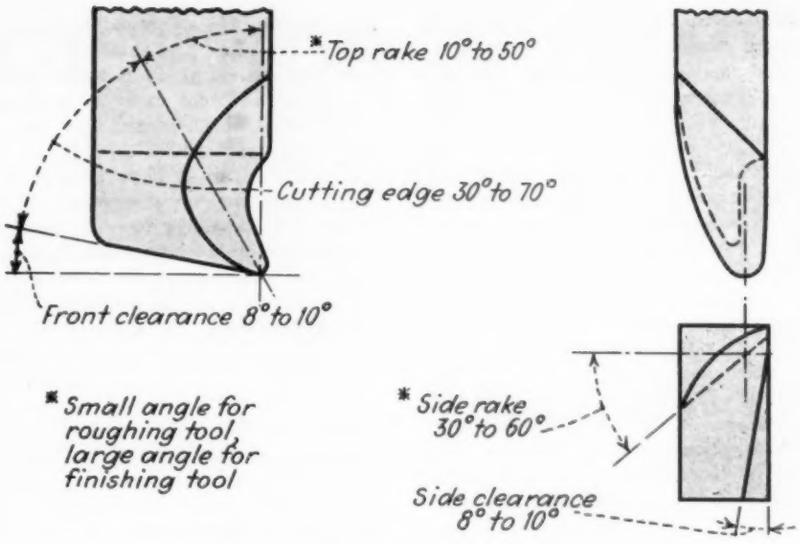
The tool illustrates the general design of all cutting tools for machining aluminum and its alloys. The lathe tool does not differ appreciably from the sketch. For thread-cutting taps, the desired hook is obtained by grinding the flutes so as to undercut the leading edge, and the side rake may be obtained by spiral flutes. Undercutting and spiral fluting are likewise employed for milling cutters. For best results, the general tool design illustrated should be carried out as much as is practical to other types of tools, including thread-cutting dies, saw teeth, and special form-cutting tools.

The hook and side rake of the cutting edge are well emphasized by the fact that they are so conspicuous. The front and side clearance angles, though small, are nevertheless important. If these are neglected, the tool will "drag" and generally heat, which may cause trouble. Proper clearance is necessary for all cutting tools and especially for saws, where the generation of heat may do much damage because the saw blade is confined on both sides. Tools should be provided with smooth surfaces, especially the surfaces over which the chips slide.

Some of the alloys of aluminum have been machined successfully without any lubricant or cutting compound, using tools of the form described, but in order to get the best results, some form of lubricant is desirable. For many purposes, a soluble cutting oil is good. Ordinary carbon oil or kerosene will often serve but usually works better when mixed with pure lard oil. The proportions of kerosene and lard oil should be governed by the character of the work being done and the cutting speed and feed being used. A satisfactory mixture for general use will be obtained by mixing equal parts of kerosene and lard oil. For heavy cuts and slow feeds, such as in roughing work or tapping, pure lard oil has been found to give satisfactory results.

The cutting speed to use for aluminum will depend considerably on the character of work being done, the type of tool used, the machine tool with which the work is done and the kind of lubricant. Generally, aluminum can be machined to best advantage by using comparatively high speeds and fine feeds.

Developments in tools to determine the best cutting edge angles and general design for machining aluminum have contributed considerably to the satisfactory application of the metal for machine uses. The introduction of cutting tools of the cemented-tungsten carbide type has aided materially in machining some of the aluminum alloys containing silicon. These new tool materials permit higher cutting speeds and give much longer tool life than is attainable with cutting tools of steel.


*Top rake 10° to 50°
Cutting edge 30° to 70°
Front clearance 8° to 10°
*Small angle for roughing tool, large angle for finishing tool
*Side rake 30° to 60°
Side clearance 8° to 10°

A planer or shaper tool for aluminum must have considerable top rake and large side rake

Even with properly designed cutting tools and the newer tool materials, aluminum alloys have been difficult to use for some of the screw-machine operations. Aluminum cuttings may foul the tools because they do not break up into small enough pieces to fall entirely free from the machine. The most recent contribution to the machining of aluminum is a new free cutting alloy, which lends itself readily to all kinds of screw-machine operations. This alloy takes a good finish; and because it cuts freely, with the production of small chips, it may be machined at high speeds.

Aluminum 11S screw machine stock can be machined, using the maximum spindle speed available for all standard types of automatic screw machines, for turning, forming, drilling and cutting off. This material has been machined at approximately 800 surface ft. per min., and there was no indication that the speed was excessive. In fact, it is difficult to state how much this speed can be exceeded. However, by using high surface feet together with excessive feeds, the chips will be quite hot and a rough finish will be produced, but no noticeable effect on the tool is observed when making short tests. It is to be expected that the continued use of a feed heavy enough to produce an exceptionally rough finish on the work would cause a breaking down of the cutting edges. The same results could be obtained by using slower surface feet and excessive feeds. This indicates that the tool feeds are of more importance than the speed of stock.

Each type of machine has a suitable speed, approximately one-third of that used for the other operations, which is considered good practice to use for threading and tapping all materials to avoid excessive wear of the machine spindle, and to maintain a uniform length of thread. In some cases the threading spindle revolves continuously in one direction, the speed in relation to the work spindles being slower for threading in and faster for coming out. On other machines the work spindle that rotates the stock is reversed from forward to backward to accomplish the threading operation. This action must take place the instant the clutch engages the mechanism which drives the stock in the direction desired. That aluminum has one-third the weight of brass is an advantage in such cases, since the lower inertia causes less wear on the spindles, belts and motors.

The 18-4-1 steel is considered a satisfactory general-purpose steel and is used for most of the high-speed tools, such as drills, taps and forming tools. Carbon steel is used for many applications in which the cutting speeds are limited. For example, a ¼-in. drill at 10,000 r.p.m. would be the equivalent of only 164 surface ft.; for this reason

many of the small drills are made of carbon steel.

For shallow depth holes standard twist drills are satisfactory. For deep holes bakelite or straightway two-flute drills are preferable. In any case, highly polished flutes are desirable, and this is also found to be an advantage in drilling all metals. The standard twist drill can be used for reasonably deep holes, but the other two types are better for the following reasons: First, the bakelite drill has a slower twist than the twist drill, which permits the chips to pass out readily. The point should be approximately 118 deg. for aluminum screw machine stock; Second, the straightway two-flute drill permits the chips to clear out of the flutes well and in many cases produces a smoother finish than twist drills.

Generally, forming tools are made without top rake. However, in many cases it is necessary to grind them with some rake to correct a slight error in the steps of the tool. When machining some metals, a top rake up to 5 deg. is advantageous and best for penetration of the material, but for machining 11S the top rake is not necessary. As a rule, forming and cut-off tools are made with a ½ deg. side clearance which will produce a smooth side finish.

For any material there is a limit beyond which it is not practical to form pieces with a side forming tool without support, for as the side pressure becomes too great the piece will spring or be twisted off. The limit is usually expressed in the form of a ratio of the formed length to the smallest diameter. For 11S this ratio should not exceed 2¼.

For box tools the section bearing on the diameter being turned should be ground on an 8-deg. angle and when set in place will be parallel to the axis of the work. The best chip condition when machining certain materials is obtained by grinding a 45-deg. groove in the tool, starting at the front corner and increasing the width as backed off, the groove to be within approximately 0.010 to 0.025 of the front cutting edge. This will produce a helical coil that will clear out of the holder. Omitting the groove when machining 11S will produce a smooth finish and well broken chips.

For tap sizes up to ⅞ or ⅜ in. the two-flute type is preferable and for larger taps the number of flutes recommended by tap makers is usually satisfactory. These taps are generally used with cutting rakes or hooks as supplied. For chasers a 10- to 15-deg. rake on the cutting edge will produce good results. On all threading tools it is important that the chamfer on the front be equivalent to not less than one thread in order to avoid pushing the material ahead of the tool, causing rough and distorted threads.

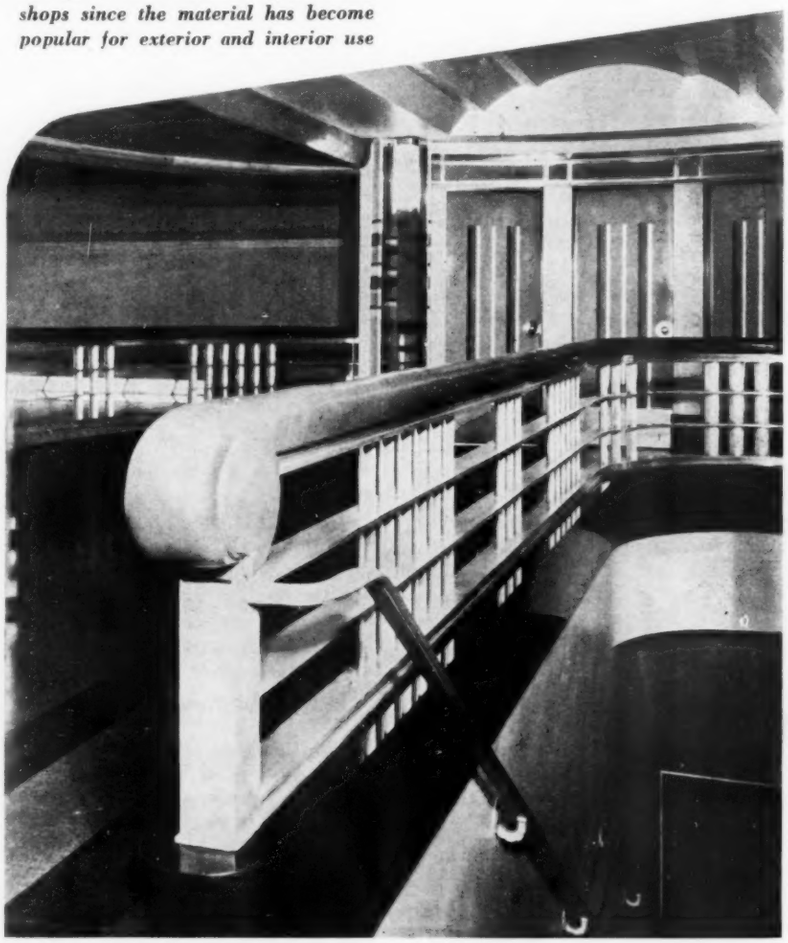
Notable advances have been made in the finishing of aluminum. The metal and its alloys have a natural thin oxide film covering which protects the metal. Advantage has been taken of this fact by applying a thicker oxide coating artificially by electrolytic action. One method of accomplishing this result is called the Alumilite process, and it enhances the corrosion resistance of the metal appreciably.

Alumiliting also improves the resistance to wear, as in the case of automobile pistons. Another advantage of the hard Alumilite surface is that it prevents smudging. Alumiliting is, therefore, used for hand railing, cafeteria trays, shoe eyelets, and many parts where smudging would be objectionable. The durability of the finish is noteworthy, as it will not chip, flake, or peel off.

The Alumilited surface has absorbing characteristics, and this permits dyeing the metal. A wide variety of pleasing colors may be applied to Alumilited surfaces. This is used to create decorative effects for many articles such as mechanical pencils, vanity cases, safety razors, jewelry and novelties.

In years, aluminum is but an infant compared with most of the other commonly used metals. This is evident from the fact that some of the men who pioneered the metal are still actively engaged in the industry. The remarkable strides that aluminum has made in this brief period, which dates from the discovery of the electrolytic reduction process by Charles Martin Hall in February 1886, have resulted from constant development to improve the metal. The ever increasing efforts of research to supply better, stronger alloys of aluminum to an industrial world that is becoming more conscious of the advantages of light weight construction, indicate an untold future for aluminum and its alloys.

Modern decorative schemes have brought much work to fabricating shops since the material has become popular for exterior and interior use



COLLEGE SHOP WORK

Should it be conducted on the same professional level as other engineering courses?

FRANK L. EIDMANN
Professor of Mechanical Engineering, Columbia University

SHOULD instruction in shop work in engineering colleges be on the same technical and professional level as other courses in the curriculum? Is this instruction of sufficient importance to warrant the amount of time that is devoted to it? With the continual demand for the introduction of new courses into the engineering curriculum, finding the necessary time for them in the schedule is a problem. To add a course necessitates a reduction in the time allowed for existing courses. When the introduction of a new course is contemplated, all courses are critically examined and they must justify their continuance as well as the number of hours allotted to them. Inasmuch as courses in shop work require many hours of instruction they are among the first to be considered for a possible reduction.

For purposes of discussion I should like to raise some questions regarding shop courses in engineering schools and colleges:

1. Should instruction in shop work be given in engineering colleges?
2. What should be the objectives of shop courses?
3. Should students in all branches of engineering be required to take a course in shop work?
4. How much time should be devoted to the shop course?
5. What should be the content of the course?
6. What should be the method of presentation?
7. Who should teach shop courses?
8. Should summer work in industry be required of the engineering student?

Should instruction in shop work be given in engineering colleges?

A well organized and well taught course in shop processes and machines should rank in importance with other engineering subjects. In discussing this with practicing engineers and executives and with engineering professors I have found almost universal agreement that this instruction should be given, but most of those with whom I talked believe that a course in which instruction consists essentially of manual training is out of date and should not be included in the college curriculum.

Professor R. L. Sweigert[1] of the Georgia School of Technology made a study of college shop courses and their evaluation. He sent a questionnaire to several hundred executives in industry as well as to deans and professors in engineering schools. In answer to the question "Should shop work be given in a professional engineering course?", 339 of the industrial executives voted in the affirmative and 119 voted negatively. Similarly, a substantial majority of the deans and professors were in favor of shop courses. Those who voted unfavorably felt that the time could be more profitably spent on theoretical subjects; that shop courses are too expensive, it being impossible to keep equipment and processes up-to-date; that these courses are too time-consuming for a four-year course; that courses involving instruction in the manual operation of machines are of high school grade.

Professor Sweigert included the question "Is shop work considered of commensurate value with other courses?"

	YES	NO
Industrial executives replied...	157	76
Professors replied.....	161	86
Students replied.....	131	90
Graduates replied.....	115	68
Total.....	557	320

A somewhat similar comprehensive survey[2] was conducted by a special committee of the faculty at Armour Institute of Technology to consider shop courses in engineering curricula. Letters and questionnaires were sent to deans of engineering; directors of shops in engineering colleges; to all graduates of Armour Institute (excepting architects) who are members of Tau Beta Pi, honorary engineering fraternity; and to a representative group of executives of important industrial organizations. The employers voted 98 per cent in favor of shop courses for mechanical engineering students. Similarly, 87 per cent of the deans of engineering who responded voted affirmatively, as did 94 per cent of the Armour alumni.

What should be the objectives of shop courses?

From my own experience in industry and teaching, I believe the objectives of shop courses in engineering colleges should be to teach the student:

1. The nomenclature of shop processes and machines.
2. The various metal-working and wood-working operations.
3. The machines and tools that may be used for these operations.
4. To distinguish between a shop operation that is well done and one that is poorly done.
5. Fundamental phenomena involved in metal working operations.
6. Economic selection and arrangement of equipment.
7. The principles of shop organization and production control.

In the report of the special committee on shop policy at Armour Institute of Technology, the objectives of shop courses are defined as follows:

The development of knowledge of shop machines and processes.

The development of knowledge of the properties of materials used in shop processes.

The development of knowledge of the fundamentals of shop economics and management.

In my conversations with educators and with industrial executives I have found a number who still believe that manual dexterity should be an important objective in college courses in shop work. There are some instructors in college shops who require students to make a quantity of similar parts under each shop exercise, to a degree approximating quantity production. The idea is to cultivate manual dexterity and at the same time approximate conditions in industry. The student punches the time clock, fills out production records, and the work is controlled as it is in a commercial shop, thereby familiarizing the student with the principles of production control.

Personally I believe that manual dexterity should be a negligible objec-

[1] *Journal of Engineering Education, June 1931, p. 657 to 687.*

[2] *"Report of Committee on Shop Policy," Armour Institute of Technology, March 1935.*

tive in laying out a college course in shop work. Likewise I am opposed to quantity production by the student. Fundamentals should be taught, and more extensive practice may be obtained in industry after graduation or during summer vacation periods.

Should students in all branches of engineering be required to take shop work?

Of the employers who replied to the Armour questionnaire, 98 per cent favored shop instruction for electrical engineering students, 95 per cent for chemical engineers, and 76 per cent for civil engineers.

Similarly, in Professor Sweigert's investigation, 267 answered affirmatively the question "Should other than mechanical engineering students take the shop course?" Only 22 voted negatively.

From time to time in their professional careers most of the graduates in all the branches of engineering have occasion to design or to supervise the construction, installation or repair of engineering equipment. It is then that the instruction in shop processes proves of considerable value.

How much time should be devoted to shop courses?

The number of hours which are devoted to instruction in shop work differs greatly in the various engineering colleges. Examination of the catalogs of eight of the well known engineering colleges reveals that the students in mechanical engineering in these institutions are required to devote to shop work the following number of hours: 522; 420; 342; 314; 270; 250; 175; 162. In addition, some of these colleges require their students to work for part of a summer in a commercial shop.

I am of the firm conviction that all that the graduate of a four-year course should be expected to know can well be covered in 150 hours of instruction.

What should be the content of the course?

Mechanical engineering students should be taught the various metal-working processes; the characteristics, constructional features, and limitations of the machines on which these processes may be performed; machine selection; shop layout; principles of production control. In addition it is of great advantage to know something about the fundamental actions and phenomena involved in the various metal-working operations. It is desirable to have some idea, for instance, of what happens in a chip when it is cut from either a ductile or a brittle metal, what is the action involved in the metal during plastic working as in deep drawing, extrusion, wire-drawing, hot and cold working; the heat treatment of metal; what is the function of a cutting fluid and why is one fluid best for one metal, another best for another metal, and why is no cutting fluid used for others. Some consideration should be given to the relationship between cutting speed, feed and depth of cut, also tool pressure; power required for metal working; economic considerations of shop processes; and the fundamentals of time and motion study.

What should be the method of presentation?

An excerpt from a letter mentioned in Professor Sweigert's report covers this very nicely: "We see no reason for considering this any different from any other course in the curriculum. On this basis it should be treated by lecture and text-book, with the other additional opportunities that may be available."

An excellent course on the professional level of the other engineering courses may consist of:

1. Lectures and textbook.
2. Demonstration of the more common machine tools and shop processes. The preferable method is to take the machines into the lecture room where the instructor can point out the important parts and explain their functions and a mechanic can operate the machines, showing the various adjustments and typical operations while the instructor explains them to the class.
3. Experimental laboratory work of an engineering nature. Assignment of engineering experiments on some of the common types of machine tools offers an excellent method of familiarizing the student in a very short time with the operation and characteristics of the machines and with the cutting of metals. Simple experiments of this kind include the determination of the cutting speeds possible for various materials when using different cutting materials; measurement of power required for cutting metals; measurement and study of the effect of changing the shape of the cutting tool; study of chip formation, tool pressure and the effect of the use of different cutting fluids. Experiments may also be performed to check mathematical formulas which have been proposed for expressing the relationships between cutting speed, feed and depth of cut.
4. Visits to industrial plants. For colleges favorably located, visits to machine shops offer a splendid opportunity if the student has previously studied about the processes and machines, and if he has a guide who is well informed and who explains well.

Who should teach shop courses?

The replies to Professor Sweigert's questionnaire indicate the belief that shop courses in engineering colleges should be taught only by engineering graduates with several years of experience in industry. If the courses are not directed by men who have had technical training there is little likelihood of the courses being on the same technical level as other courses in the curriculum.

I agree with Professor Sweigert in his statement that "A high type of instructor with poor equipment will do decidedly more effective work than a poor instructor with excellent equipment."

Should summer work in industry be required of the engineering student?

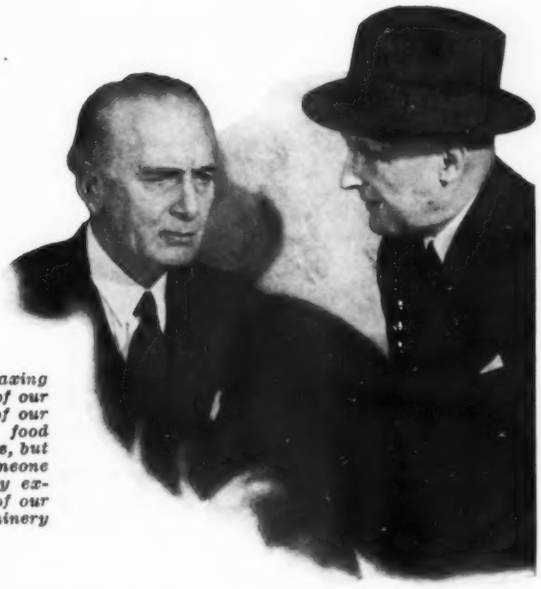
A number of colleges require their students to work for a summer in a commercial machine shop. In some colleges this work supplements the course in shop work and in others the summer work replaces entirely the class instruction.

There is much to be gained by spending a summer in a progressive shop after having had instruction in the fundamentals of the shop processes and machines. In addition to obtaining practical experience and having the opportunity of confirming his work of the classroom and laboratory, the student learns much by "rubbing elbows" with the men in the shop. He also learns about shop layout, shop organization and procedure, production control, and the relationship of the shop departments to the engineering, purchasing and sales departments. Unfortunately, however, it has become increasingly difficult to obtain summer positions or even to obtain permission to spend the time as observers without pay. Many colleges have therefore had to drop this requirement.

In most cases where the student is obliged to work in a shop without first having had instruction in the fundamentals of metal-working, he is under great handicap and he learns only a fraction of what he would if he previously had a good course in shop processes.

Let me refer again to Professor Sweigert's report. The replies to his question "Should summer shop work in industry be required?" indicate that this work is not favorably considered by the majority of the 344 industrial executives who responded. Only 125 voted for it while 219 opposed it.

Talking Shop



Congressional orators are waxing eloquent over the deficiencies of our defenses and the inadequacy of our airplane reserves. There is food enough for serious thought here, but how helpful it would be if someone in authority would get equally excited about the shortcomings of our arsenal and navy yard machinery and equipment.

Continuous X-Ray Inspection

X-ray machines and methods are making their way into industry. While the Watertown Arsenal has done great work in investigating the soundness of welds and of castings, its equipment involves the use of a lead-lined room and considerable time. For some uses, at least, we now have X-ray equipment that takes its place in the production line and permits continuous inspection.

A works manager who has developed a good apprentice school, and is proud of it, proposes an interchange of visits between delegations from his plant and from plants where like schools exist. He would send one instructor, one foreman and his best senior apprentice, and would welcome visits in return. College and school teachers have profited from such visitations. Why not apprentice training groups?

Streamlining in 1893

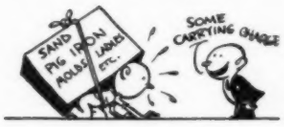
Streamlined trains are attracting the attention of railway managers as well as the traveling public. It has taken a long time to realize what air resistance means. For on January 17, 1893, patent No. 489911 was issued to F. U. Adams for a streamlined train that bears a startling resemblance to those that are just being tried. The patent says, "This invention has reference to the construction of railway trains with the primary object of diminishing atmospheric resistance to their movement and with the ultimate object of making a higher speed of such trains attainable with a given expenditure of motive power." Of course, we had no duralu-

min nor high strength steels in 1893. But some are skeptical enough to believe that the automobile, the bus and the motor truck have had more to do with the sudden interest in streamlining than the newer materials now available.

700 to 1

Cost of handling was under discussion recently among a group of engineers. One asked if anyone knew how many tons of material was handled in a foundry to get one ton of castings from the molds. Estimates varied widely but all were dumfounded when he stated that between 700 and 800 tons have to be handled for every ton of finished castings.

This includes handling pig iron and other materials from the car, moving to the charging platform, handling the sand, the molds, the patterns, the ladles and all the rest, not only once, but many times. This has been done for so many years we have not considered it in all its significance. Much



of this handling may be unavoidable. But as long as it exists it is a direct challenge to every engineer in the materials handling field.

While handling materials in the shop is a much less serious problem, it is safe to say that most plants can find ways of reducing handling costs to a lower level by a careful study of all the factors involved.

One company, which needs semi-skilled men, has been able to secure only about three or four suitable men out of every hundred applicants. It has set up its own training course, because it is more economical and more satisfactory in the long run. Another company, which employs production workers largely unskilled, puts an experienced man on the job of working with and watching closely two or three "green" men to keep spoilage down.

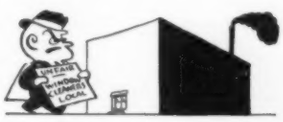
Dip Plating

When it comes to "laying it on thin" dip plating, or deposition by immersion, to use a more hifalutin term, is about the last word. It isn't new, having been used by makers of cheap jewelry for many years. One authority gives the thickness of such a plate as 0.000001 in., a millionth of an inch which is *some* thin. And yet it is said to be quite dense and until it wears off you have a surface of real gold.

Transfer of the temporary quarters of New York's Museum of Science and Industry has given valuable publicity to a worthy enterprise. Much of the misunderstanding of facts and economic fundamentals that has enabled the rabble-rousers to get people to believe that machinery caused the depression would be dispelled if more such places existed. Familiarity with machinery and what it does should make the public more willing to accept its economic contributions to our physical well-being.

Another Windowless Factory

Windowless factories have long been discussed pro and con. Now another one, of three stories, is under construction at Hershey, Pa., for the well-



known chocolate maker. Few doubt that increased bodily comfort can be had in such buildings due to better lighting and air-conditioning. There are, however, grave differences of opinion as to the psychological effect on workers. —*The Editors.*

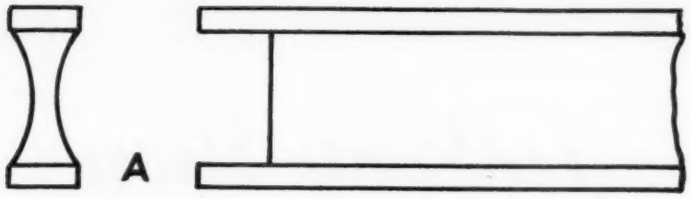
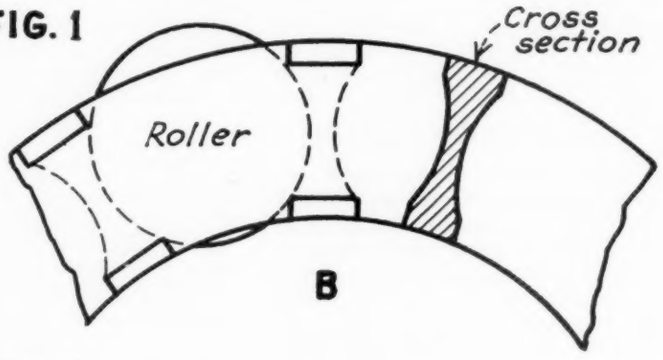


FIG. 1



BEARING SPACERS SHAVED and SHEARED

Two die sets for roller bearing parts successfully overcome burr and bending troubles

WILLIAM C. BETZ

Equipment Engineer, Fafnir Bearing Company

DISTORTION or flow of metal can not always be foreseen, and as so frequently happens, some modification or even redesign of press tools may be necessary before they will produce satisfactory work. Not long ago we had a job which required two sets of tools and which seemed comparatively simple. Fortunately, the first set of tools could readily be modified to overcome distortion, but for the second operation a new set and a different method were found necessary.

The job was to make a large quantity of spacers for the cages of large roller bearings. Cold-rolled strip stock, concaved to suit the curvature of the rollers, was the starting point. The problem was to obtain lugs as at *A*, Fig. 1, on the ends of the spacer to give a convenient means of attachment to the end rings of the cage. The simplest method appeared to be, first, punching rectangular holes in the concaved web of the strip and then severing the thin connecting portions. The resulting lugs could then be spot welded to the end rings after insertion of the rollers, as shown at *B*, Fig. 1, which gives a partial view of the assembly.

For piercing the rectangular hole the strip was fed to the stop *A*, Fig. 2. At the first station the hole was pierced 0.020 in. undersize, and then advanced to stop *B*, where the hole was shaved. Stop *C* located the finished hole so that the next hole would be at the correct center distance.

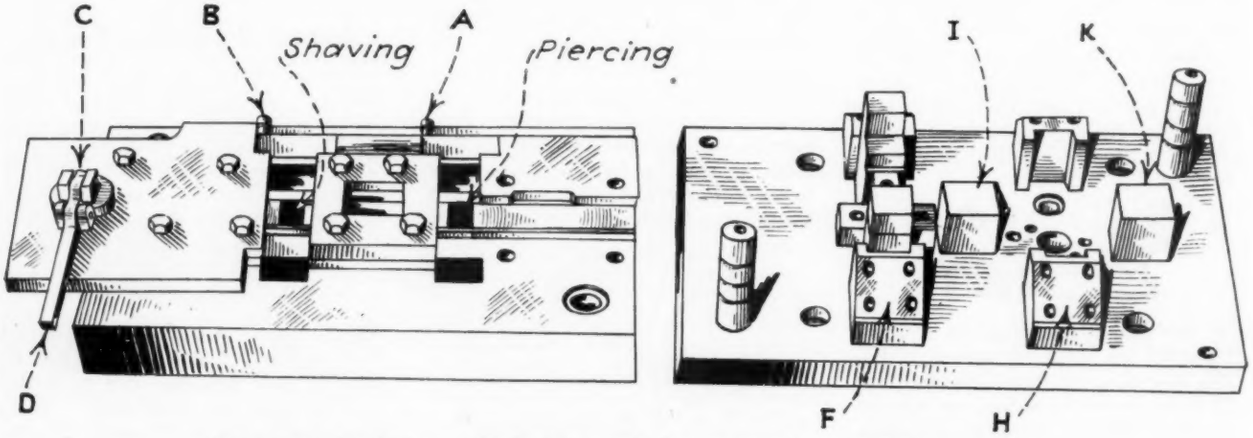


Fig. 2—Pads I and K were added to the punch plate to strike the stock lightly, thus overcoming the bowing of the spacer through the action of the piercing and shaving tools

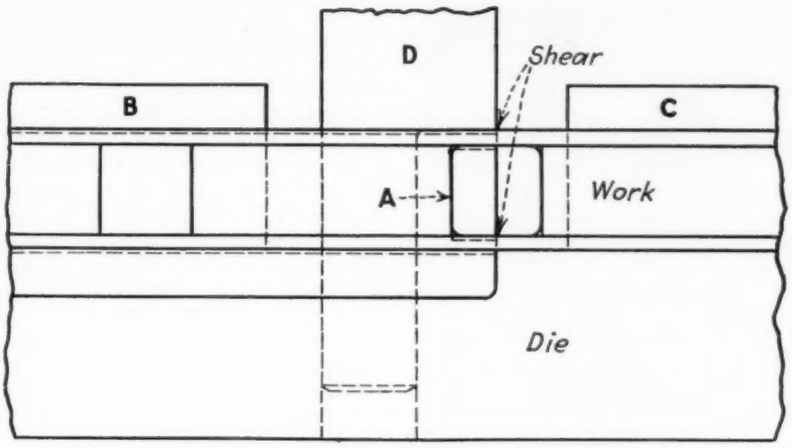


Fig. 3—Instead of lying flat the stock is stood on edge and the pierced hole slid over the two-piece mandrel A for shearing.

Stop *C* is a rectangular plug that fits nicely into the shaved hole and into a bushing of the same size. It is ordinarily pressed downward by lever *D* to engage the shaved hole. Lever *D* is actuated by a tension spring attached to the ram, but when the ram descends the spring tension is overcome and an adjustable setscrew depresses the lever. Thus, the plug is removed from the gaged hole so that the stock can be slid along to the next slot into which the plug will slip when the spring tension is again made operative as the ram ascends.

Pilot hold-downs and punches have been removed at *H* for the sake of clarity. As the ram descends part way the hold-downs make contact with the stock, and the springs under the hold-downs are compressed, thus holding the stock firmly while the piercing and shaving tools operate.

In the piercing and shaving operations we ran into trouble. The stock was badly bent because of the swaging action of the tools. To eliminate this we put pieces *I* and *K* on the punch plate to strike the stock a light blow and straighten it.

We failed in our first attempt to sever the punched strip at the connecting portions. In these tools we laid the stock flat and tried to shear the strip the wrong way. As the end view at *A*, Fig. 1, shows, the lug is comparatively thin but relatively wide. Thus, with the stock laid flat we were shearing through the longer dimension The lugs distorted badly and such a large burr was thrown up on the sides that the spacers could not be used.

When it was realized that the connecting strips must be sheared through the thinner section, we designed the tools in Fig. 3. In them the strip is stood up on edge, and the problem is to shear both top and bottom lugs simultaneously. The punched hole is slipped over the two-piece square mandrel *A*, and backed up by stops *B* and *C*. As punch *D* descends and starts to shear the stock, it transmits pressure through the stock to the left-hand half *A* of the square mandrel as will be seen in Fig. 4. This half of the mandrel now acts as an auxiliary punch and shears off the lower lug against the die proper. The right-hand half of the mandrel remains stationary, performing the function of a die for the upper lug. With this design shearing of the top and bottom lugs starts simultaneously, and being through the thinner section it is done without distortion.

These tools produce 400 pierced and shaved holes per hour and 500 severed pieces per hour.

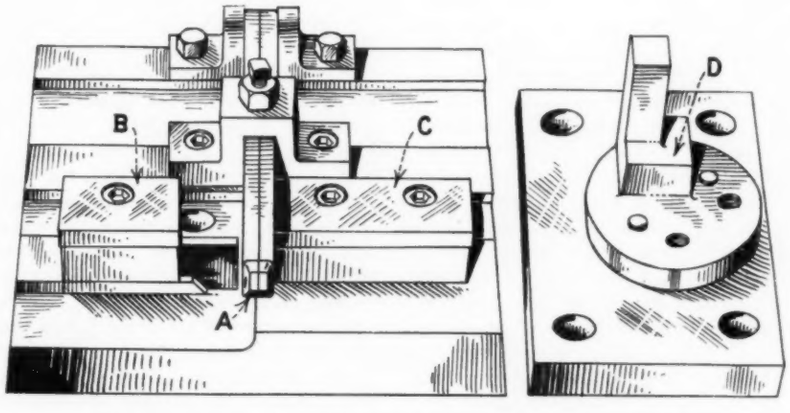


Fig. 4—Pressure of punch D on the upper flange transmitted to half of split mandrel A shears both flanges simultaneously

How Alloy Steels Were Started

In a recent address before the American Institute Metal Products Exhibit of Rockefeller Center, Frederick B. Hufnagel, president, Crucible Steel Company of America, recalled the beginning of alloy steels which have had so marked an influence upon our mechanical progress. Said Mr. Hufnagel, "While iron has been well known for centuries, the first scientific efforts recorded to improve the properties of this old and useful element by alloying it with other elements are found in the historical work of Farraday in 1820. He, at that time, demonstrated that the properties of iron and steel could be altered and improved by small additions of nickel and chromium. One of the steels which commanded Farraday's admiration was that containing 3½% nickel—a very popular steel of today in automobile and machinery applications.

"Commercially, however, the alloying of iron and steel was not made until shortly after the middle of the last century when Mushet discovered that wolframite added to the iron in the crucible imparted to the steel self-hardening properties highly desirable in tool steels used in cutting metals. From that time on until 1890 additions of various elements were made to steel for the purpose of increasing its efficiency as a tool. Alloy steel until that time was practically confined to tool use.

"By 1890, the United States Navy had begun to use alloy steel for armor plate, it having been found that nickel greatly improved the ballistic properties of that article, and by the end of the century nickel steels were used extensively in making 16-in. guns."

Fig. 1—Three parts are located concentrically in a simple turntable fixture for welding an 18¾x2 in. tractor wheel

Rolled steel shapes and plain castings are combined to avoid the use of complicated components

TRACTOR WELDS in SIMPLE SET-UPS

FRED B. JACOBS

MACHINE designers of a generation ago were firm believers in the so-called one-piece construction. In the manufacture of many machine components elaborate and expensive patterns were necessary for molding intricate castings. Costs were prohibitive according to present-day standards. But with the general introduction of the welding process in the last few years, designing methods have been revolutionized, and welded structures are now preferred for numerous classes of work.

For large equipment the combination of rolled members and castings by welding frequently achieves cheaper and stronger construction than by casting. This method is particularly applicable to the crawler-type tractors built by the Cleveland Tractor Company, and is a part of the regular production. A variety of means is employed for holding the components while building up welded assemblies.

One of these is a turntable fixture, Fig. 1, which is employed in fabricating a wheel 18¾ in. in diameter by 2 in. wide. Wheel components consist of a formed sheet-steel disk, a formed steel rim and the hub. These parts are located concentrically in the fixture on the turntable. For the convenience of the operator the whole is tilted to a comfortable working position. The turntable makes one revolution every 2 min., deriving power from a fractional-horsepower motor and reduction gearing. Thus, the operator can concentrate on welding alone, and a smoother and more satisfactory joint is the result. As made by welding the wheel is stronger than a steel casting and is much cheaper.

Welding need not be confined to joining one part to another; it can be used to fix one part in relation to another. In a bearing support assembly, Fig. 2, the shaft is held in place by a press fit in a bracket, but permanency of location is assured by welding around the end of the shaft as at *A*, where it comes through the hole in the bracket. The shaft is 16 in. long and 3 in. in diameter. To be sure, the shaft might be pinned in place, but the hole for the pin weakens the construction somewhat and is more expensive than welding. This example is illustrative of the many instances where welding can be employed to insure joints that will not work loose.

The combination of rolled and cast parts permits the making of relatively complicated structures from simple components. For example, formed

plate and cast parts make up the tractor side frame, Fig. 3. This assembly is 32 in. long, 7 in. wide and 16 in. high. The tube *A* and the four screw lugs *B* are welded in place at one end. As shown at the right the other end requires a closure plate. Besides these parts the assembly shown in Fig. 4 must go in the bottom. The four bosses of the bearing housings must be welded to each side of the formed side frame.

The four bearing housings in Fig. 4 are permanently fastened to the oil tube by welding. A special fixture supports the work, spacing the bearing housings and aligning them. Both sides of the lug on each bearing housing are welded to the tube. As compared with a steel casting, fabrication of the side frame in this manner reduces the production cost and gives an assembly considerably stronger and in better alignment.

A welding jig for building up a track frame housing is shown in Fig. 5. This

Fig. 5—A simple fixture holds the two cast end-pieces and the rolled connecting piece of this track-frame housing while welding on the sides

Fig. 4—This oil tube and bearing housing assembly goes in the bottom portion of the tractor side frame, Fig. 3. Better alignment and lower cost result from this construction

Fig. 3—Welding and press work combine to make this tractor side frame from boiler plate and small castings

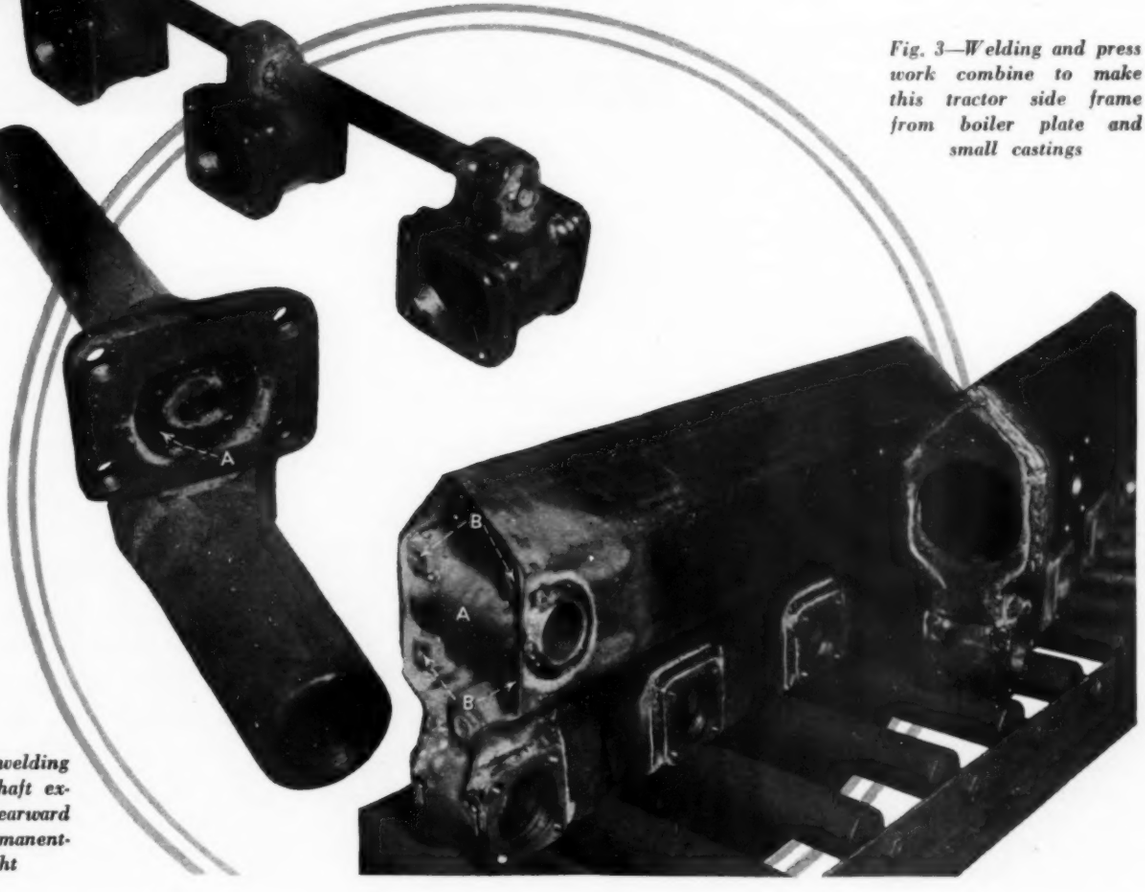


Fig. 2—By welding at A the shaft extending rearward is made permanently tight

part is 6 ft. long, 10 in. wide and 14 in. high. The plate is ½ in. thick and the end pieces are cast steel. For convenience in welding at the ends the work is hung in a pit, Fig. 6. The unit thus built up is amply strong to withstand severe tractor service, and takes the place of a complicated casting.

The welding equipment used at the Cleveland Tractor plant generally operates on 500 amp., 75 volts, open circuit. Current is supplied by generators driven by 15-hp. motors, and in most cases the generating equipment is mounted overhead while the control aparatus is placed conveniently for the operator. Heavily coated electrodes from ⅛ to ⅜ in. are used. Welding booths are of sheet steel about 5 ft. high and many of them are served by roller conveyor systems, which are necessary to facilitate transportation of the comparatively heavy units.

The foregoing examples are only a few of the welding operations performed regularly by the Cleveland Tractor Company, but they are indicative of what modern welding methods can do to reduce production costs in various manufacturing operations.

Fig. 6—To get at the ends, the track-frame housing is hung in a pit

Aprons and Apprentices

CHARLES WESLOW

Will somebody page a manufacturer of toolmakers aprons? I want to buy two that are provided with zippers in the back, instead of the time worn strings. And I want the mike and scale pockets nearer to the middle of the apron than are sewed on by commercial makers. In the old Western Electric toolroom, they used to wear aprons homemade out of striped bed ticking. One apprentice, Newton Thornton, had a white apron, and we all called him a dude toolmaker. Newton was a wonderful kid. I won in a raffle, a mechanical book, and made him a present of it. It was swell taking an interest in such an apprentice.

Reminds me of the apprentice I met in a Newark shop. I took an interest in him, too, and made a toolbox for him and gave him some fine tools. But I took a greater interest in him, because after I learned his name it developed that I was the man who was trying to marry his mother. Another guy stole her from me. I just couldn't help but love this apprentice almost the same as if he were my own son, and me with a wife and two growing children. He disliked the trade, and gave me back the box and tools. He was born in the month of June, not a good month for mechanics. (Employment agencies please copy.)

The latter apprentice turned out to be a bartender.

Hoops Started It

Today's flourishing business of making watch springs in Connecticut had its start in the manufacture of invisible hoops for milady's skirts of nearly a century ago, according to the transition recently displayed at the Connecticut Tercentenary Industrial Exposition. In 1847 Col. E. L. Dunbar started the first American spring factory in the town of Bristol, and because of his superior tempering methods, was soon supplying most of the forms for hoop skirts.

Another manufacturer, Wallace Barnes, joined with Colonel Dunbar in 1857, and together they erected a factory called "Crinoline Hall" to accommodate their growing business. When the fashion for these circular garments disappeared about 1863, Dunbar and Barnes turned to making springs for clocks and other manufactured articles.

In 1866, Wallace Barnes bought out Colonel Dunbar's interest, and from then on, his spring plant closely paralleled many of the inventions of that era. Among these were the screen tension spring, piano action spring, bicycle bell spring and sewing machine spring.

Chief inventions which aided the development of the company up to the World War were the telephone, bicycle, automobile, typewriter, and other electrical and mechanical appliances. During the World War all spring concerns in the state aided in the manufacture of rifles, pistols, machine guns, heavy artillery springs and fuses. Today the Wallace Barnes Company is combined with several other concerns under the name of the Associated Spring Corporation.

MODERNIZING AN ARSENAL

II—After selection of a new machine, as described in the previous article, comes appraisal by the cruel critics of the shop where it is installed. A good demonstrator can do much to make judgment favorable

D. G. McGREGOR
Captain, Ordnance Department, United States Army

THE shop superintendent who assumes that his modernization problem is solved when new equipment is procured and installed, is in for a rude awakening. The selection of a machine, regardless of the completeness of data and accuracy of past performance records, is at best a theoretical proposition, while the results obtained will depend on the solution of practical problems. None of the points discussed herein may be new, but the extent to which they affect the successful adaptation of new equipment may not be fully appreciated. The manner in which a new machine meets its anticipated task will appear in the records but the factors which actually influence its success or failure may not be known or realized until too late to evaluate them properly.

It is doubtful if there is any more critical jury to examine the evidence and exhibits of a modern age than a group of "old timers." Certainly the skilled machinists are no exception. Place a new machine in a shop and it will be inspected critically (during odd moments) and definite judgment will be reserved. In a jobbing shop, especially, it will find its own level of popularity with the men, and the activity of the shop will go serenely on with few comments or criticisms reaching the inner sanctum of the superintendent. Place a hundred new machines in the shop, however, and withdraw all the old ones which they replace, and judgment is no longer reserved nor entirely reliable.

In a machine tool, as in most items of our complex civilization, first impressions are important. Stream-lined simplicity, chromium plated handles, beautifully scraped bearing surfaces, favorably attract the true machinist and create in him a desire to try out the new machine. Balance and proportion, substantial and finely finished operating mechanisms, convenient grouping of controls, are points which he instantly notices, and accepts as an indication of equal value in the parts he cannot see. It "looks like a machine," hence it must have all the inherent merit of a high quality article. An attractive exterior, however, cannot conceal inadequate engineering design, and too obvious "window dressing" serves only to create scepticism in the minds of prospective operators.

If the new unit is a standard type of familiar make, the first inspection reveals the presence or absence of changes which the "old timer" thinks should have been made. The "special features" of which the salesman has been so enthusiastic are viewed in the cold light of past experience, and unless the basic design of the machine is superior and his pet improvements apparent, no new devices can save it from disparagement. If the new item is a special purpose tool of radically modern operating characteristics, the "old timer" is extremely hard to convince that the technique which he has spent a lifetime in acquiring can be surpassed by the brain child of some engineer—an inanimate creature of iron and steel, having no heart but an electric motor, and no soul whatever.

In the past few years most machine tool builders have radically improved and re-designed their lines. It is unfortunate, but true, that the older units of some makes were notably inferior to other competitive items. Today the merit relationship may be reversed, but in a shop which has had no new equipment for some time, past performance records are not lightly thrust aside. The mere name of an obsolete mechanical cripple on a modern successor is sufficient to place it indefinitely on probation and to magnify the normal adjustment troubles to the proportion of major failures. Conversely, the decision of an executive against a favorite make of machine which he considers no longer at the top of its class is received with the usual tolerance toward the theorist; and there is no defense since the item preferred by the shop was not procured.

The Demonstrator

It can now be appreciated that the demonstrator or factory representative who arrives to start a new machine in a customer's plant and nurse it through the first spasms of adjustment is confronted with a job which goes far beyond the skillful pulling of levers. He has a sale to make, more difficult than his colleague who actually took the order, and a machining job which frequently places him definitely "on the spot." Where the salesman can base his arguments on results that should be obtained with average personnel on average work, the demonstrator must base his campaign on the performance of actual work (selected for him by his severest critics), and the training of specific human beings who may or may not qualify for the average assumed by the salesman.

At Watervliet Arsenal, for example, one of the first pieces routed through a 6 in. heavy duty turret lathe was a 340-lb. Monel metal forging to be bored 5 in. in diameter by 20 in. long through a 3½-in. hole. The opening was finished with several counterbores and an internal thread. Careful scheduling was required to obtain desired results with the available tool positions.

Practically the first job expected of a heavy duty 44-in. x 21-ft. gun lathe was to turn a ½-in. pitch thread 11 in. in diameter by 8 in. long on a gun tube forging of alloy steel, with tolerances of the order of 0.001 in. There was no considerable amount of straight rough turning available for a run-in period

before requiring the ultimate in slow speed and fine finish.

On a new No. 4 plain milling machine, steel forgings of about 320 Brinell hardness were given a form cut 4 in. wide by 1 in. deep by 18 in. long, meeting a cut previously made by profiling. While this latter did not tax the ingenuity of the demonstrator, it proved to be a thoroughly strenuous workout for the machine.

For specialized tools, an early job for an automatic tool-room machine was a profile cut on a 3,500-lb. forging which proved to be just about all the table would carry. A centerless grinder was initiated with an aluminum bronze roller permitting 0.0002 in. variation in outside diameter, fairly close limits for straightness and roundness, and calling for a superior finish. This was followed by a ½-in. by 3-in. pin of stainless steel having a ⅛-in. slot practically its entire length. A precision boring machine was started off boring a ½-in. hole 2 in. long in aluminum bronze, and then fell heir to the task of finishing bearing seats in steel castings.

A CHECK on the relative efficiency (and popularity) of a fairly diverse group of new machines after approximately one year of operation suggests that the work of the demonstrator is largely responsible for the results obtained. A clever operator, before a critical mechanical audience, cannot entirely overcome errors of judgment in machine selection, but he may be able to reduce the unfortunate effects of an unwise choice by developing uses for the equipment which may not have been realized. The converse is not equally true, for an operator who is lacking in ability or is temperamentally unsuitable for his work, can build up antagonism toward anything which he represents. The customer expects that a demonstrator shall excel in engineering ability, operating skill and maintenance knowledge, and also be a competent instructor. His work requires that he be, to some extent, a student of psychology, suiting his methods to the personnel with whom he deals.

Service and Maintenance

The purchaser of a new automobile is warned to break it in gradually, to use special lubricants, and to return it regularly for servicing. He expects a definite period of inconvenience and inefficiency, and accepts it as an inevitable step toward future satisfaction. How many shop executives habitually require and supervise a similar breaking in period for new machine tools? Does the six or eight thousand dollar machine receive the same chance to prepare for its life work that is habitually accorded the automobile costing a tenth as much? The demonstrator should be able to put over this idea where it will do the most good without at the same time suggesting that there may be inherent weaknesses which must be humored as long as the machine is in use.

Since all mechanical equipment requires maintenance, a demonstrator should contact the maintenance department and, if possible, explain in detail all the repair jobs which his equipment may require. After checking installation, he should pay special attention to adjustments, lubrication and type of lubricant, points of difference between new units and old units which may be still in use, and indicate those repairs (if any) which should not be undertaken locally, with reasons therefore. It should be realized by all concerned that failures may occur, that a machine is earning only while working, and that, within reasonable limits, a good machine shop can, if necessary, completely rebuild any machine in the plant. A full understanding of the servicing problem will save time and money for both customer and dealer through facilitating local repairs and reference to the manufacturer of only those problems which actually require his assistance.

Where machinery is procured under a definite guarantee, complete maintenance records are essential during the guarantee period, and desirable thereafter. Minor breakages will occur, through improper adjustment or unfamiliarity with the equipment. Such failures may be of no consequence in themselves, but definite records, and suitable corrective action, will prevent the discrediting of a valuable machine, and will forestall (or explain) more serious troubles which might occur. Proper administrative control will identify the responsibility of the contractor and furnish valuable data for consideration in connection with possible future procurement.

Recent experience has shown that a good machinist can learn the operation of a new machine, even a special purpose unit, in a very short time, and can produce better work more quickly than he could on the equipment which it replaces. Modern manufacture, however, goes farther than this, if full value is to be derived from new equipment. Advantage must be taken of the inherent rigidity and accuracy of new tools, and their higher cutting speeds, to extend the range of work beyond that possible on older units. Turret lathes which have alignment accuracies within a half-thousandth per foot of travel of units, and high spindle accuracy, are capable of operations formerly assigned to good engine lathes. Horizontal boring, drilling and milling machines of high accuracy are capable of competing with jig borers. Where rigidity is built into them, they can perform deep hole drilling, and to a greater extent, heavy, fast and accurate milling.

In many shops, routing is a responsibility of the foreman, insofar as selection of machine and determination of feeds and speeds are concerned. In some instances this may even be left to the machinist who does the work. In these cases, increase in the rate of doing work will depend on the shop's conception of its ability to master the new technique, and increased efficiency is definitely beyond the control of the superintendent. Where new rates are set arbitrarily in the office, the desired results may be obtained eventually, through the various stages of coaxing, pleading, threatening, and club wielding—at the expense of a temporary increase in spoiled work.

A New Standard

It has been noted that most modern machines are capable of speeds and feeds far in excess of those formerly believed to be usable, and that they are equipped with direct reading dials or plates to show the rates being used. Assuming that the supervisor will take advantage of this increased productivity, he can readily check machine performances and keep the output of his department up to the standard set.

He will be confronted with two problems. The first will be tool life. Increases in rate of metal removal call for new types of tools, which in turn require mechanical sharpening equipment, (grinders for accurate sharpening of cemented carbide tools, drill grinders, etc.). Efficient use of this equipment requires special tool maintenance personnel. Until these modern tools, accessories and attachments are obtained and put in use, the basic machine is essentially no better than its predecessor and the ultimate economies claimed by the manufacturer will not be realized.

The second problem is more complex and more difficult of solution, since it involves the human element. The situation may be compared to that of the man who has been used to driving his automobile at 30 m.p.h. and who, in a new car, raises his average speed to 50 m.p.h. Although this similarity has been questioned by students of shop management, it cannot be denied

that physical reaction and increased mental concentration are involved. Other factors are also present, namely, fear of spoiling the work before the machine can be stopped, and in some shops, fear of running out of work faster than it can be supplied.

Redesign of Facilities

There is an additional problem in speeding up production which goes beyond the foreman's jurisdiction. Increased metal removal usually calls for different methods of holding work. Shorter unit production time may indicate fixtures that can be loaded and unloaded more quickly. In order to take full advantage of greater productivity, therefore, tool redesign may be largerly involved. Revised thinking and modern methods are as essential here as in the operating departments, since tool making offers possibilities of as great improvement as is obtainable in production.

Some commercial plants and most government arsenals maintain quantities of special tools, jigs and fixtures against possible future production requirements. These facilities may be applicable to particular machines which are considered for replacement. The effect of modernization on the usefulness of such facilities becomes rather startling when some job calls them into service, and it is then found that the machine for which they were built has passed on to the junk pile. It is unfortunate if the estimates for the job happen to have been revised downward in consideration of new equipment, without providing for necessary retooling! In estimating probable savings in new equipment over old, there should be added to machine cost the cost of special cutting tools, sharpening tools, fixture redesign (where these are applicable), and an adjustment made for the time required to step up the operator's speed. These additional factors are required, and consequently must be charged. If they are not included, the effective saving consists of little more than reduced maintenance and improved accuracy, and true modernization is not realized.

Machine Characteristics

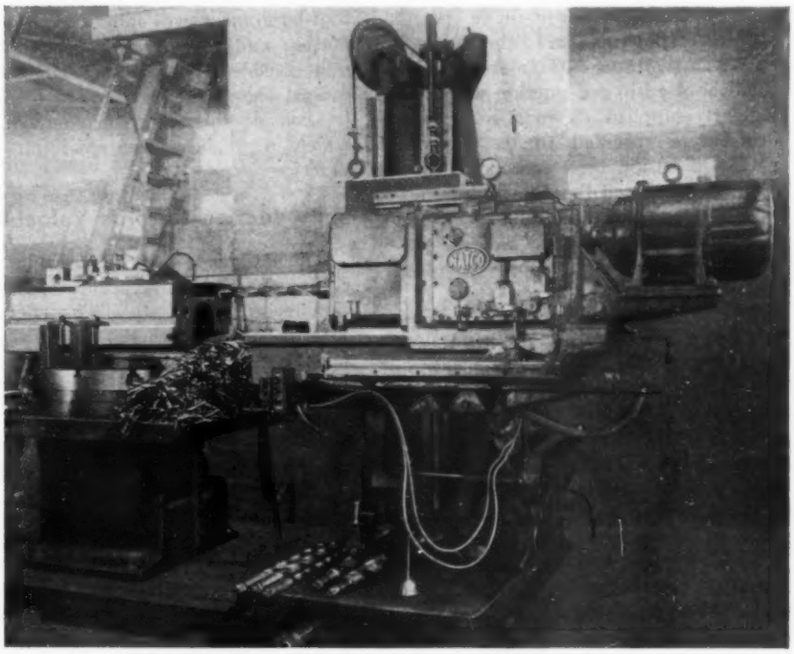
In the straight production type shop where equipment can be bought for special purposes and paid for through economies effected in a definite group of operations, much of the modernization problem can be solved before procurement of the machines. In a jobbing shop, of the government arsenal type, particularly, effective modernization is a function of the adaptation of standard equipment to the more efficient performance of a variety of work.

This requirement calls for versatile units, with complete equipment and accessories, involving large initial expenditures. It follows that equipment must be first quality, heavy duty, and supplied with correspondingly high grade attachments. Turret lathes must have complete bar and chucking equipment, threading attachments, extra chucks and turrets. Plain milling machines should have vertical attachments, slotting attachments, dividing heads, circular tables and spiral milling attachments.

Versatility requirements may be best indicated by the increasing use of the horizontal boring, drilling and milling machine, from 6 two years ago to 22 at present, with operations including milling, drilling, boring, facing, precision threading, jig boring and tapping, on materials including aluminum alloys, Monel metal, iron and steel castings, and steel forgings. These machines also are fitted with a variety of high grade attachments, some of which are designed for special purposes.

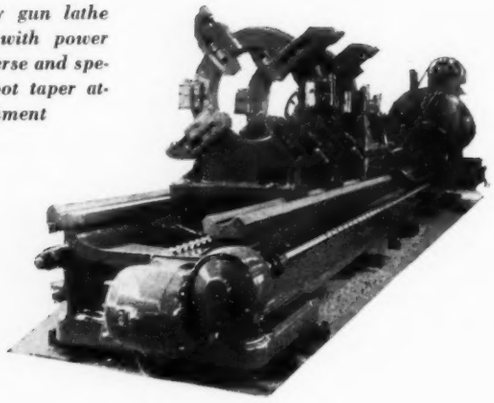
Although production type machines are not generally suitable to versatile requirements, instances occur in which the special characteristics of some unit recommend its procurement and the development of various uses. The precision boring machine has proved its value even on small lot production, through its accuracy, ease of operation, and the release of more versatile equipment for other work. The centerless grinder has afforded the possibility of using intermediate sizing operations between rough turning and finishing, and has permitted form grinding with greater accuracy and uniformity than was possible on centers.

While Watervliet Arsenal does not usually resort to machine design in the solution of its equipment problems, there are occasions where modifications of available standard items offer many of the advantages of special purpose machines without too great loss of versatility.



Adaptation of a standard machine unit to a special job which has proved to be quite a time-saver

An interesting special purpose machine was recently constructed, using a standard hydraulic deep hole drilling unit on a special knee to replace the head unit on a conventional floor type horizontal boring machine. The elevating and traversing mechanism was modified and provided with direct motor drive for positioning the drill. The unit has drilling capacity from 1 in. to 3 in. in diameter by 27 in. deep in steel, and provides a step drilling cycle which is fully automatic when manually started. A standard preci-



Heavy-duty gun lathe equipped with power rapid traverse and special six foot taper attachment

sion type circular table is mounted on the regular table in order to drill accurately from opposite ends of the work without relocating it.

To a lesser degree, three large gun lathes recently procured called for departures from standard in a power operated rapid traverse to the carriage, and a 6-ft. taper attachment which could be used in conjunction with that regularly supplied. Two 21-in. upright drills were specified to be provided with a precision type compound table having coarse and fine interlocking adjustment. While these tables were not generally available at the time of procurement, they are now standard items.

And to a greater degree, it became necessary to collaborate in the design of a small, accurate, fixed table horizontal drilling machine when no suitable standard tool could be found for a certain group of special operations. Visits to a number of industrial plants where similar operations were observed suggest that this machine, too, may soon become commercially available.

Planning Problems

The interrelation of shop planning and production as affected by modernized equipment is too broad a field for limited discussion and too varied in practice for generalization. In those cases where definite routing of work is made in the planning organization, it must have adequate technical personnel who can familiarize themselves with the capabilities of the new machines and reroute work to make use of these facilities. This is another fertile field for a competent demonstrator, and for this reason the shop superintendent should not neglect the potential advantage of contacts with him.

One important function of the planning organization is the keeping of production records for future planning and for estimating costs on incoming work. Since the purpose of modernizing equipment and methods is to reduce cost of doing work, these records of performance are subject to corresponding changes. In a plant where each estimate is based on original study at the time, close contact with the shop is assured. Where estimates are based on records of past operations (either similar or identical) the effect of possible savings due to various (or new) methods is not always considered. Frequently habit and the existence of tool equipment will influence the estimating and routing of a job without due consideration or knowledge of a radical change in process which might be considerably more economical, or which might have been just put into practice.

Production Records Valuable

The existence of considerable tool equipment and fairly accurate production records has a stabilizing effect on manufacturing methods, but it should not hinder desirable improvement to meet modern conditions and tools. These facilities enable the prompt and economical supply of replacement parts for the repair of equipment in the field. They insure interchangeability, and permit the publication of price lists for administrative use. To the Government, they also provide the means of initiating production in an emergency and permit the preparation of definite manufacturing data to assist in the development of plans for the mobilization of industry when and if the need arises.

The military establishment must be prepared for its possible emergency mission. Arsenal modernization, therefore, must look beyond the efficiencies of the present and measure all improvements by their probable emergency values. Methods and equipment which are adopted should be those which most nearly coincide with similar commercial practices and equipment when industry must turn to munitions production.

Efficiency of plant operation is not a goal, but only a route to be traveled, and modern equipment is the vehicle. The vehicle is efficient only so long as it is modern, so that true modernization involves constant change, or growth, in machinery which is used by men. The successful growth of an enterprise may be measured by its demand for improved equipment and not by the extent to which new equipment forces it into new channels of thought and action.

Part I—Selecting the equipment was published in a recent number; *Part III—Modernization and the emergency mission*, will appear shortly.

Half-Baked Mechanics

O. W. SCHRICKER

In a recent number (*AM*—Vol. 79, page 750) the statement was quoted that, "America has produced more half-baked mechanics than any other country in the world."

The truth of this statement and the reasons for it are obvious when one analyzes the situation.

In the first place, industry has not done its part in making it easy for a boy to learn a trade. In the second place, industry has little to offer a boy after he has given his time to repay him for the sacrifice he has made in lower earnings.

Anyone who has had occasion to interview prospective apprentices, as I have, finds it hard to meet some of the arguments they can present. The one most commonly advanced and the one hardest to answer is that of earnings.

The boy will point to this or that friend of his age who, after a few months' experience learning one operation, is earning more than is promised him after two or more years of training. Try it some time if this statement is doubted.

And what is offered him in earnings after his training period is over? The specialist or machine operator, learning only one or two operations, is able to show greater return because of the wage incentive systems commonly employed.

Learning a trade does have its advantages over not learning one. The all around mechanic or toolmaker does not have to work at top speed all day to prevent a shut-down in a production line. His work is more interesting, in that it varies from day to day; his surroundings are better as a rule; his associates are usually of a higher type; and his working life longer.

But to a boy earning his first money and knowing that the trained mechanic seldom receives as much as the production operator, these facts are hard to put across.

Editorials

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K. H. CONDIT • F. H. COLVIN
—EDITORS—

LET'S LOOK AT THE RECORD

AL SMITH'S famous sentence has led up to many a devastating attack on political incapacity. He has also used the "record" to prove the soundness of certain time tried economic truths as contrasted with the falsity of impractical theories, and with telling effect. Why should not the same method be equally effective in discovering whether machinery is really the villain so many of our labor-minded contemporaries claim it to be?

Let's look at the record as interpreted within the last few days, first by the Machinery and Allied Products Institute and then by the National Industrial Conference Board. These organizations have based their findings on the record. No new facts are involved.

Turn over two or three pages of this issue and you will find summarized the ten facts on technology and employment which the Institute has gathered into a modest pamphlet. In substance the verdict is that "the net result of technological advancement is a great increase in employment and attainment of a higher standard of living."

The Conference Board concurs in this verdict and finds further that "the answer to the problem of unemployment does not lie in placing restrictions on the use of machinery but in increasing the volume of production, which would increase the purchasing power of the people and lead to full re-employment."

THE record is plain to most of those engaged in the metal-working industry, but it will do them no harm to have it stated once more, clearly and briefly. Some of them were coming perilously close to a permanent inferiority complex brought on by the constant reiteration by labor leaders and New Deal theorists that machinery caused the depression.

Quoting the record to the theorists will probably have little effect. They have already embarked, through WPA, on a twelve-million-dollar "research" into technological unemployment which looks suspiciously like an attempt to substantiate an idea.

But to bring the facts of the record before the rest of the people, some of them pretty tired of New Deal disappointments, cannot help but do good. It should have been done before, and it cannot be done too often.

Arsenal Modernizing

IN the last issue we started publication of a three-part series under the title "Modernizing an Arsenal." This time we offer the second installment. The conclusion will appear in the first issue in March. Reference is made to it here in the hope that those who missed the first part will go back and read it, and then finish the article as soon as it becomes available.

This series has a double value. In the first place it presents a remarkably well thought out modernization policy for a government manufacturing establishment, a policy that could be adopted quite as well by any private enterprise operating with some irregularity and faced with the need of being prepared for emergency expansion.

In the second place it calls attention to the need for immediate action in the interest of national defense. This country is fanatically desirous of avoiding war but there is no way of insuring that another world conflagration would not involve us. And that outbreak may be nearer than most of us realize. Isn't the best insurance we can buy the putting in order of every section of our defensive armor?

Chips

WASHINGTON—Joint Democrat-Republican House committee will investigate activities of Townsend Plan and like movements . . . Speeches on Army Bill emphasize weaknesses of aviation branch and coast defenses . . . House passes record Army bill increasing enlisted strength to 150,000 and providing for modernization of some equipment, but adds vicious amendment limiting profits to 10 per cent . . . Congress passes AAA substitute ignoring pleas that it is no more nearly constitutional than the original . . . Roosevelt invites American countries to conference, suggests Buenos Ayres as location, Brazil would like to have it in Rio . . . Senate Agriculture Committee approves scheme to spend billion for farm electrification . . . Carnegie Foundation report warns legislators of danger of generating new pension lobbies by ill-considered pension grants . . . FHA industry loan provision likely to be extended when it expires April 1 . . . Supreme Court upholds right of federal government to sell Wilson Dam power, does not pass on soundness of TVA project as a whole . . . Temporary neutrality act is extended for a year . . . Drastic firearms control bill voted as Senate ends munitions inquiry.

FOREIGN—Hitler gives secret police greater power to stamp out political moves of Catholics and Communists . . . Nationals abroad ordered to register . . . Hitler's denunciation of Rapallo Treaty and resulting military agreement between France and Russia viewed in Europe as fatal error . . . Italians defeat Ethiopian army on northern front . . . Reds win Spanish election and riots follow . . . Paraguayan president deposed by revolution . . . Swiss government outlaws Nazi groups in that country . . . British rearmament plans send stocks of munitions firms up briskly . . . Former Herriot of France reminds French deputies that there is still a war debt owing to the United States . . . Germany decrees a new variety of depreciated mark for travelers, the seventeenth kind of mark invented by Dr. Schacht, but it is going to be more expensive for Americans than the registered mark used heretofore.

FINANCE—Reports of banks to Federal Reserve disclose steady decline in earning ability . . . Jones & Laughlin stockholders approve hundred-million mortgage, of which $25,000,000 is to be spent for new strip and sheet mill, and smaller sums for other improvements . . . Export-Import Bank of Washington, under new officers, extends trade loan term to five years.

INDUSTRY—Largest steel rail orders since 1929 are placed, others approach consummation . . . A. O. Smith Corp. books million-dollar pipe line order . . . Federal prosecution of interstate racketeers, under 1934 anti-crime law with drastic penalties, starts in New York . . . A. F. of L. instructs members to seek higher wage rate . . . Good orders put Briggs plumbing division on 3-shift basis . . . Edw. G. Budd Co. disposes of its British affiliate, Pressed Steel Co. of Great Britain, Ltd. . . . Railroad unions oppose Eastman's terminal consolidation plan because of lost jobs . . . Union Pacific to order 12 mammoth Mallet compound locomotives and 750 freight cars and build 250 cars in its own shops . . . Strike shuts down Goodyear Akron plant . . . Green warns unions of his flock not to have any traffic with John Lewis . . . Pelley tells mining engineers' meeting that pending legislation would raise the freight cost on every railroad carload at least $20, points out need for modernizing motive power and rolling stock if present and future burdens are to be met.

TRADE—Swiss-American trade treaty takes effect, increases quotas of American exports materially . . . Railway Express Agency survey shows that business in 1935 was up 11.6 per cent over 1934.

INDICATORS—Steel output rises on strength of heavy goods orders . . . Electrical energy production continues at rate 10 per cent over 1934 . . . *Business Week's* index declines to 69.4.

Watching Washington

Congress and WPA move to put machine age on the spot . . . TVA decision leaves much in doubt . . . Farm plan passed to replace AAA . . . Investigation ordered on old-age plans

WASHINGTON — When enraged textile workers broke Hargreave's spinning jenny in 1770 they believed they were protecting their own interests. Their alarm over this new and unfamiliar force in the industrial world is easy to comprehend.

What is not so easy to understand is how the sophistry that caused their violence has endured to the present day. Everyone who enjoys the products of the machine must be conscious of the fact that our present standard of living would be impossible without them. And it must also be apparent that the "machine age" is still young and capable of producing greater abundance. Yet we still have those who would in one way or another sabotage mechanical progress because of their own pet theories of economics.

In Washington two moves toward legal "sabotage" are evident. One of these is the WPA project under the direction of David Weintraub "to study the effect of recent changes in the techniques of production on the volume of employment and unemployment." This study is to be financed under a $12,000,000 allotment for "factual guidance of administrative policy and action."

House Lends a Hand

The second move is House Resolution 49 which would empower the Secretary of Labor to determine the effect on industry and employment of labor-saving devices put into operation since 1912. This measure, introduced by Rep. Palmisano, of Maryland, would seem to the uninitiated to be a duplication of the WPA project. But of such are the mysteries of democratic government.

Last week the first hearing was held on this resolution by a subcommittee of the House labor committee, with Rep. Lesinski as chairman. The only witness to appear was A. F. Heinrich, of the Department of Labor, who explained that unemployment in industry caused by labor-saving devices would have to be broken down into three classes: that caused by mechanical devices, that caused by adaptations and improvements of existing devices and that caused by nonmechanical devices, such as scientific management.

Tax-Paying Machines

At the conclusion of Mr. Heinrich's statement Rep. Palmisano revealed the purpose he had in introducing the resolution. He said he wanted the information it would furnish for emergencies, so the facts of the situation would be known and if it was warranted, machines and labor-saving devices could be taxed for old-age pensions and unemployment insurance.

Rep. Gildea also indorsed regulation and limitation of machines and limitation of machine work hours. Chairman Lesinski concurred with his two colleagues, as did Rep. Eagle of Texas, another member of the subcommittee, who wandered in just as the hearing was about to close.

For probably the first time in hearings on legislation, the secretary of a subcommittee was allowed to examine witnesses. Chairman Lesinski's secretary practically took the hearing over in its closing stages, asking Mr. Heinrich if he would indorse regulation and taxation of machinery and whether or not he thought Communism was "common sense." Mr. Heinrich evaded the questions on the ground that he did not think a government employee should answer them. Hearings will be resumed on March 2.

New Dealers who had previously classed Supreme Court justices as an uncompromising group of tories felt more kindly toward the old gentlemen after the TVA decision. In it they saw complete vindication of their power program and immediately began talking of a Mississippi Valley Authority, a Red River Authority and several other replicas of TVA.

"Incidental" Power O.K.ed

Actually the opinion studiously avoided decision of any point not vital to the rather narrow case before it. The ultimate solution of just how far the government may go into private business is still up in the air. Apparently each case must stand on its own bottom, the essential question being whether some good constitutional excuse can be found for a given operation, thereby justifying what the government wants to do.

In looking toward decisions on other cases, such as many of the PWA variety, two very sweeping points are important. One is that the government, once the original operation is found to be constitutional, acquires the incidental power developed which may be sold as it may desire; also that to build transmission lines so as to reach a wider market is sound.

Best legal opinion is that the TVA decision puts the seal of approval on Grand Coulee, on Bonneville and on Fort Peck. In each of these cases it is believed that the TVA opinion with respect to navigation being a sound constitutional excuse for the project would permit sale and distribution of "incidental" power developed.

The question of legality did not deter the Senate from passing, 56-20, a farm plan to replace the defunct AAA. Under this bill the Secretary of Agriculture is given practically unlimited power for two years to make grants to farmers based on the productivity of their land out of an authorized fund of $500,000,000. After January 1, 1938, a permanent system would become operative with states having the right to adopt control programs subject to federal formulas and receiving federal subsidies to carry them out.

Pension Plans Probed

With both parties flocking to its support, the House last Thursday passed a bill to investigate all old age pension schemes with particular emphasis on the Townsend Plan. Rep. C. Jasper Bell, head of the "non-partisan" investigating committee and author of the resolution, summed up his views in the statement that as a "doctor of the ills which affect our social structure, Dr. Townsend is a charlatan and a quack."

Organized Hudson Motor

Underwood & Underwood

ROY D. CHAPIN

Roy D. Chapin, Head of Hudson, Is Dead

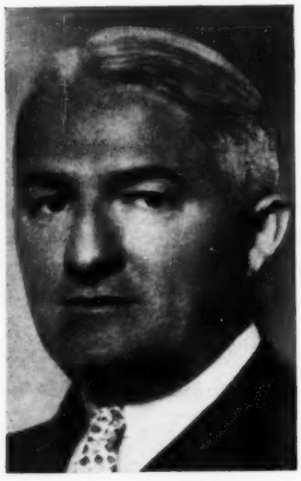
Roy Dikeman Chapin, president of Hudson Motor Car Co., and from August, 1932, to the following March, Secretary of Commerce in President Hoover's cabinet, died February 16 in the Henry Ford Hospital, Detroit. He was 55 years old.

A recognized leader in the world movement for better highways, Mr. Chapin was chairman of the Sixth International Road Conference, and was made an officer of the Legion of Honor for his efforts to promote international goodwill through easier travel.

He drove the first motor car ever to make a trip from Detroit to New York under its own power, taking photographs along the way which were used to promote the sale of the vehicle, an Oldsmobile. Three years later he was made general sales manager of the Oldsmobile Co. Two years later, with E. R. Thomas of Buffalo, Howard E. Coffin, F. O. Bezner and J. J. Brady, he organized the E. R. Thomas-Detroit Co. A little later he organized the Chalmers-Detroit Co. with Mr. Coffin and Hugh Chalmers. A year later he organized the Hudson Motor Car Co., with E. L. Hudson, Detroit merchant, as president. In 1910, a year later, he became president of this company continuing in that capacity, with the interruption as a cabinet officer, until his death.

In 1927 he was elected president of the Automobile Chamber of Commerce, now the Automobile Manufacturers' Association, and was an active figure representing the industry during the days of the NRA codes.

Continues Hudson's Policies



A. EDWARD BARIT

A. E. Barit to Continue as Manager of Hudson

A. Edward Barit will continue as general manager of Hudson Motor Car Co., Detroit. A new president, to succeed the late Roy D. Chapin, will be named soon by the directors. Mr. Barit has been with Hudson since its beginning and recently has been the active head of the company as vice president, general manager and treasurer. At one time he was secretary to William J. McAneeny, who later became president of the company.

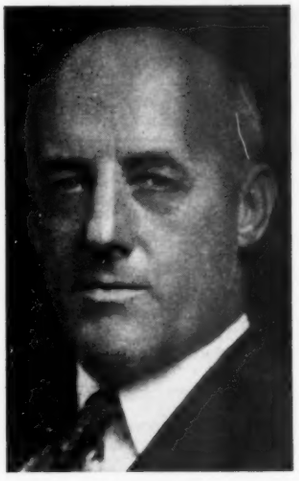
"Side-Line" Items Prove Profitable

Ingeniously developing new products to keep their plants busy during the ebb of the depression, more than a score of automotive manufacturers have found these by-product items important factors in their 1935 earnings statements.

Some of these companies, with their side-line products, are:

General Motors Corp.; air-conditioning.
Chrysler Corp.; air-conditioning, heating units.
Continental Motors Corp.; farm lighting units, air-conditioning.
Edw. G. Budd Mfg. Co.; railroad trains.
Eaton Mfg. Co.; airplane and railroad coach parts.
Briggs & Stratton Co.; fractional-hp. motors.
Briggs Mfg. Co.; pressed steel plumbing ware.
Timken-Detroit Axle Co.; oil-burners, humidifiers.
Motor Wheel Corp.; oil-burners, heaters, ranges, oak whiskey and steel beer barrels.
Bohn Aluminum & Brass Co.; parts for domestic appliances, architectural fittings.
Bendix Aviation Corp.; air-conditioning controls, marine accessories, electric outboard motors.
Electric Auto-Lite Co.; electric clocks, flash lights, arc welders, dry-cell batteries.
Borg-Warner Corp.; refrigerators, washing machines, air-conditioning, gas and electric ranges.
McCord Radiator & Mfg. Co.; refrigerator trays, heating units.
Sparks-Withington; air-conditioning.
Hayes Body Corp.; parts for refrigerators.
Parker Rustproof Co.; parts for domestic appliances.
Reynolds Spring Co.; household utensils, radio parts.
Houdaille-Hershey Corp.; airplane and refrigerator parts.
L. A. Young Spring & Wire Co.; bed springs, upholstery parts.
Kelsey-Hayes Wheel Co.; steel frames for homes and buildings.
Detroit Steel Products; steel window sashes and frames.

To Head Electrical Engineers



A. M. McCUTCHEON

A. I. E. E. Nominates Officers for 1937

A. M. McCutcheon, engineering vice president of the Reliance Electric & Engineering Co., Cleveland, Ohio, has been nominated for the presidency of the American Institute of Electrical Engineers.

Vice presidential nominees of the Institute, to fill vacancies on August 1, are:

A. C. Stevens, General Electric Co., Schenectady, N. Y.; O. B. Blackwell, Bell Telephone Laboratories, Inc., New York, N. Y.; Prof. C. Francis Harding, Purdue University, Lafayette, Ind.; L. T. Blaisdell, General Electric Co., Dallas, Texas; and C. E. Rogers, Pacific Telephone & Telegraph Co., Seattle, Wash.

Nominees for directorships are:

K. B. McEachron, General Electric Co., Pittsfield, Mass.; C. A. Powell, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; and Prof. R. W. Sorensen, California Institute of Technology, Pasadena, Calif. Prof. W. I. Slichter, Columbia University, New York, N. Y., has been nominated for treasurer. Election will take place this Spring.

Motors AND OTHER MATTERS

Despite cold, car sales break records . . . Frozen ruts will help sales . . . Farmers are buyers . . . 1937 will be bigger die year . . . Tool buying is up . . . Internal labor scraps weaken organizing . . . Lewis has big task

BURNHAM FINNEY
Western Editor

DETROIT—At the year's start the outlook for the first quarter in automotive circles seemed bright, but recently it has become bleared from the ice and snow of an almost unprecedented winter. Not alone have retail sales been partially paralyzed; factories have been badly handicapped in driving truckaways of new cars from assembly lines to dealers' establishments. Blizzards likewise have played havoc with movement of new automobiles by rail.

The result is that the industry is going into March considerably behind the schedule originally contemplated. It had anticipated a lull for a few weeks in January and February to be followed by a sharp recovery in operations by March 1 at the latest. But obviously it is hard to arouse people to enthusiasm, even over a new motor car, when they are busy at home shoveling coal and snow and thawing out frozen water pipes. Moreover, the National Automobile Dealers' Association has been advising its members to forget about new car sales until they have disposed of some of the trade-ins on used car lots.

325,000 Units in February

It appears that February assemblies are likely to be around 325,000 units, although some companies are running so irregularly that their totals are hard to estimate. March doesn't loom as the big month which the industry had hoped for, although expansion should be well under way the latter half. Steel mills have on hand material rolled for February delivery for which they haven't yet received shipping releases. The same is true of parts suppliers. A late spring start thus seems inevitable.

There is decidedly a cheerful aspect to the situation. Even with the bad weather last month, passenger car registrations broke all previous January records. In California and the South, blessed with more moderate temperatures, retail business has been excellent. Even in the shivering northern sections retail deliveries have been astonishingly good in view of the number of impassable roads and the general disruption of transportation. All of which leads the industry to think that 1936 still will be a sales bonanza. A leading automotive executive points out that cars and trucks have depreciated more in the last month than they would ordinarily in an entire year and in the end the record-smashing winter will have been beneficial to the industry by hastening replacement sales.

Farm Sales Outlook Hopeful

What may be expected in farm buying of automobiles this year is indicated by Chevrolet's recent experience. During November, December and January it sold 133,000 out of 247,000 new cars to customers in towns of 10,000 population or less. At the same time it sold to people in rural districts 136,249 heaters, 45,000 radios, 24,000 sets of seat covers and 79,669 electric clocks. That is just the beginning of what Chevrolet believes will be a flood of car purchases by farmers during 1936.

It is significant that builders of higher-price cars have not had to cut schedules so sharply as makers of smaller cars. Packard is making 5,500 units this month and will establish an all-time high next month with 7,500 jobs. Lincoln has quickened its Zephyr operations to 125 cars a day, the present plant capacity, but further machinery is being installed to raise output soon. There is such a demand for Airflow Chryslers and De Sotos that the factory can't keep pace with sales.

Popularity of the Lincoln-Zephyr and the Airflows is likely to have great influence on the industry in styling 1937 cars. No one has yet come into the open with plans for a rear-engine job, and any move in that direction would first be made by a small-volume manufacturer. However, body lines next year will be far closer to the Zephyr and Airflow design than they are today. It is also only a matter of time until all cars have steel tops and all-steel bodies. It is understood that Fisher Body is embarking on a comprehensive tool and die program which probably will result in further elimination of wood from its bodies next year.

Machine Buying Is Heavy

Although little tool and die work has been let for 1937, it is believed that by March 15 a substantial amount will have been placed. Buick has closed for some of its 1937 die requirements, while Chevrolet has bids out for certain die jobs. Intense competition is anticipated between shops in the Detroit district and those outside Michigan for next year's business, with local companies probably getting the larger share of the orders. Shops specializing in building jigs and fixtures are being hit by the practice of most automobile makers of contracting for equipment completely tooled by the manufacturer.

Cadillac is reported to have bought crankshaft equipment and will make further purchases in the near future for the purpose of cutting costs. Chevrolet has a large program pending, including orders for transmission departments at Saginaw and Muncie. Most equipment orders are still being held up by Ford.

Independent springing appears due for gains in 1937. A prominent manufacturer is seriously considering it for next year, competition from General Motors apparently forcing its hand. The so-called air spring is being thoroughly investigated by several automobile companies, but chances of its adoption next year are slim.

Chevrolet has ordered some presses for its new commercial body plant at Indianapolis to supplement the battery of presses bought several months ago. When the new plant is completed, Chevrolet will pull into it much stamping work now being done at other plants.

The sudden death of Roy Chapin last week was a hard blow to Hudson. Hudson has been doing well thus far during the 1936 season, having im-

proved its position compared with the previous year.

Willys-Overland next month will begin assembly of 15,000 cars authorized by the court. It is reported that after that production run has been completed, the company will be reorganized with David Wilson in command and will become more of a factor in the automotive market.

An important automobile company is preparing to make its own shock absorbers next year. Electric Auto-Lite is expected shortly to announce its entrance into manufacture of spark plugs and speedometers.

What is likely to happen in automotive labor circles is anybody's guess. Dissension is raging between Francis J. Dillon, president of the United Automobile Workers of America, A. F. of L. affiliate, and the more radical officials under him. Each group has set up its own offices and is issuing charters to locals. Mr. Dillon gained the enmity of a powerful faction when he made a settlement with Chevrolet at Toledo last May against their wishes. This faction was further antagonized in August when President Green of the Federation foisted Mr. Dillon upon them as president of the new international union. Now that the union has been granted complete autonomy, Mr. Dillon realizes that his days are numbered and is not standing for reelection at the convention in April.

The industry, of course, is glad to see union leaders fighting among themselves instead of spending their time trying to foment trouble among its employees. Its main concern is not about the private scrap within the U.A.W., but about John L. Lewis and his proposed program of unionization. It isn't inclined to discount Mr. Lewis' ability, but it thinks he has cut out for himself the biggest job he ever tackled, if he counts on creating an effective union organization in the automotive field. No one else has been able to do it and the industry doesn't think that he can.

* * *

The day of the "mobile home" is here, in the opinion of William B. Stout, famed designer and builder of the Scarab car. Mr. Stout has designed and is about ready to market a house which collapses into compact form to be hauled by automobile. The house in transit is 16 ft. long and 6½ ft. wide. It opens out into a living room 14x20 ft. supplemented by a completely equipped kitchen.

Table I—Index of Orders Based on Volume of Shipments for 1926

Month	Index of Orders			3 Months' Average Index	% Foreign to Total Orders
	Domestic	Foreign	Total		
1935—May	57.3	16.0	73.3	67.1	21
June	75.5	15.6	91.1	76.7	17
July	82.5	37.3	119.8	94.7	31
August	78.2	47.6	125.28	112.2	37
September	54.1	25.9	80.0	108.5	32
October	79.5	23.4	102.9	102.9	23
November	79.2	19.4	98.6	93.8	19
December	78.1	20.2	98.3	99.9	21
1936—January	95.7	15.1	110.8	102.6	14

Table II—Index of Orders—By Size of Companies

Month	Index of Orders			No. of Reports	% Foreign to Total Orders
	Domestic	Foreign	Total		
Group A—Companies reporting year's sales in 1926 of $200,000 or more:					
1935—May	57.3	16.7	74.0	83	23
June	76.0	16.0	92.0	88	17
July	80.3	38.8	119.1	87	33
August	77.2	49.3	126.5	85	39
September	53.0	27.0	80.0	87	34
October	78.2	23.9	.....	86	23
November	77.4	19.7	97.1	84	20
December	76.6	21.0	97.6	86	21
1936—January	96.5	15.5	112.0	87	14
Group B—Companies reporting year's sales in 1926 of less than $200,000:					
1935—May	57.3	3.2	60.5	55	5
June	68.1	10.9	79.0	69	14
July	117.6	13.8	131.4	62	10
August	95.4	19.1	114.5	58	17
September	72.0	7.8	79.8	63	10
October	101.6	13.4	115.0	61	12
November	109.9	13.7	123.6	60	14
December	104.2	6.1	110.3	56	5
1936—January	82.6	8.4	91.0	60	9

Table III—Distribution of Orders

Average Indexes of Individual Companies	Companies in Per Cent of Total Number Reporting				
	1st Qtr. 1935	2nd Qtr. 1935	3rd Qtr. 1935	4th Qtr. 1935	January 1936
100 or more	16.7	21.6	36.3	35.6	38.1
60–99	16.9	22.0	17.2	21.7	22.5
20–59	39.6	31.2	31.6	27.7	27.2
Less than 20	26.8	25.2	14.9	15.0	12.2
	100	100	100	100	100

Charles E. Williams

Charles E. Williams, 73, superintendent of the machine shop of the Alliance Machine Co., Alliance, Ohio, died Feb. 21 at his home in that city, following an illness of three months.

American Broach Bought By Sundstrand Company

Purchase of the American Broach & Machine Co., Ann Arbor, Mich., by the Sundstrand Machine Tool Co., Rockford, Ill., has been ratified by the stockholders. Francis J. Lapointe, formerly president of the Michigan company has been elected a vice-president of the Sundstrand company. D. A. DeLong, formerly secretary of the American Broach & Machine Co., was elected assistant treasurer of the Sundstrand Machine Tool Co. Other officers are Hugo L. Olson, president; Levin Faust, vice-president; George A. Lindblade, secretary and treasurer, and Gust A. Ekstrom, assistant secretary and treasurer.

January Machine Tool Gain Continues Trend

A 22-per cent increase in machine tool orders for January, as compared with December, continued the upward trend for the past three months, the index of the National Machine Tool Builders' Association shows. The January index was 110.8, bringing the average for the past three months to 102.6, where 100 equals the average monthly shipments during 1926.

The index shows that the larger companies are forging ahead of the smaller manufacturers which have shown consistent strength during most of last year in holding the leadership in domestic sales. The smaller companies, however, reported a slight increase in foreign business.

During January, foreign orders of the reporting companies dropped from 21 to 14 per cent of the total.

Table III, shown on this page, has been revised to show the companies in each index group in percentage of number reporting. This method shows more clearly the steady increase in the number of companies whose index is climbing to the higher averages.

Machines Do Not Destroy Industry

In his nation wide broadcast from Detroit, February 16, W. J. CAMERON of the Ford Motor Co., pointed out that mechanization actually aids industry and employment despite widespread claims to the contrary. Mr. Cameron stated in part:

"Nothing human is so near perfection as to be immune from change. Many things interfere with employment, and some of them are almost ludicrous. When college boys rolled down their socks, every garter manufacturer in the land felt the shock of it in unemployment. A fancy for going hatless descends on people, and hatmakers go on half time. Witness the hat-tossing ceremony on baseball fields and elsewhere to inaugurate or close the straw-hat season—it directly refers to employment. When silk stockings and short skirts came into fashion, the makers of cotton stockings were reduced to hardship, and vast depression fell on the woolen and worsted trades. A billion dollars' worth of business a year was lost because of those simple style changes. That, of course, is not the complete story—the total manufacture of stocking now is a much larger business than when there was only white or black cotton hose for choice.

Useful Products Persist

"The fact is, *no useful industry is ever superseded.* Take the electric light—did it destroy the gas industry? Not at all. Gas ceased to be our principal illuminant, to be sure, but the other uses of manufactured gas have increased its consumption 500 per cent in the last thirty years. Did perfecting the gas lamp destroy the oil industry that supplied the fuel for our kerosene lamps? The oil industry, thanks to the motor car, is greater than ever before. Gas and kerosene and electric light combined could not abolish the candle. Half a million candles are made every working day in the city of Syracuse alone. Good and useful things never disappear. Radio does not abolish the telephone, any more than the telephone abolished the telegraph that preceded it.

"Again: *no useful industry is destroyed by mechanization;* on the contrary industries are enlarged by the use of machinery. Shoemaking and printing are both ancient trades, once performed entirely by hand, but now as completely mechanized as anything we know. The scribes of Paris kept the printing press out of that city for years, on the ground that it would abolish their employment. Yet there are now more scribes and printers because of machinery, and more shoemakers because of machinery, all of them receiving higher wages than at any time in the history of these trades. And that does not include the men employed in making, selling and installing shoemaking and printing machinery, or those who supply the raw materials."

Foundry Group Elects R. S. Hammond

R. S. Hammond, vice-president, Whiting Corp., Harvey, Ill., has been elected president of the Foundry Equipment Manufacturers Association, Inc., 1213 West Third St., Cleveland, Ohio. Other officers chosen were B. C. Trueblood, Arcade Mfg. Co., Freeport, Ill., vice president; and Arthur J. Tuscany, executive secretary. New Directors elected to fill expired terms on the board are E. O. Beardsley, Beardsley & Piper Co., Chicago, Ill.; R. W. Hisey, Osborn Mfg. Co., Cleveland, Ohio; and Thomas Kaveny, Jr., Herman Pneumatic Machine Co., Pittsburgh, Pa. Plans were made at the annual meeting for a display of foundry equipment at Convention Hall, Detroit, Mich., May 4 to 9.

Equipment Makers' Head

R. S. HAMMOND

Industrial Review

• **REPORTS FROM** principal industrial centers of the country indicate that sales of machine tools and machinery during February will probably be about as good as the satisfactory January record. At the moment no serious labor difficulties are being encountered in the metal-working industry and there is no expectation of immediate trouble. Several machine tool builders report increasing foreign sales.

• **IN THE EASTERN** territory served by Boston, New York and Philadelphia business has continued at a good level through February although there has been some evidence of easing up in the Philadelphia district. Inquiries continue to be brisk and deliveries have occasioned some annoyance. Conditions seem to be holding rather firm in Pittsburgh, distributors there reporting that immediate prospects are exceptionally good. As in the East, the delivery situation has caused some difficulty.

• **OPINIONS DIFFER** on the state of the market in the Cleveland district, some companies reporting that February will be well below the January level, others that it will be above. Backlogs in the machine tool plants are sizable. Inquiries are numerous in the Detroit area and a fair number of orders are being taken. The prospects for the next three or four months are excellent. The labor situation seems to be well in hand. Toledo reports an increase in employment and production, good inquiries for machine tools and orders.

• **CINCINNATI BUSINESS** in February will apparently exceed the January record. Foreign business has been good and promises to get better. There has been some agitation in labor circles but nothing that has approached a break. In Indianapolis inquiries and orders are keeping up in fair shape and spring prospects are good. Scattered labor troubles are of no very great importance. Sales have declined somewhat in St. Louis but inquiry is active.

• **CHICAGO MACHINE** tool markets have changed little, this month being well above the corresponding month of last year. Opinion is that the trend is upward and will be accelerated when the weather opens. No serious labor difficulties are reported from this area. The same upward trend seems to prevail in and around Milwaukee, manufacturers there reporting a greater scarcity than ever of unskilled help. The labor situation is quiet on the surface.

Finds Machinery Creates Employment

A major influence in shaping American civilization, machinery has created work and contributed to a higher standard of living, a report made by the Machinery and Allied Products Institute shows

MACHINERY has created jobs rather than destroyed employment opportunities, a study of technological advancement made by the Machinery and Allied Products Institute, Chicago, Ill., shows. The study is reported in "Ten Facts on Technology and Employment," summarized below.

"Machinery exerts one of the major influences shaping American Civilization," the report says. It has made available countless goods and services unknown to an earlier generation; it has removed from modern life much of the hard physical labor of past years, both industrial and domestic. Yet machinery is unjustly blamed for many of the economic and social problems of the day.

A study of technological advancement over the past two generations reveals that the net result of machinery "is a great increase in employment and the attainment of a higher standard of living through the efficient production and distribution of goods and services."

1 Jobs Increase Between 1870 and 1930, the population of the United States increased 218 per cent, while the gainfully employed increased 291 per cent. At the beginning of this 60-year period, before the great strides in technological advancement had taken place, 32.4 per cent of the population was employed. In 1930, the demands for more goods and services for a higher standard of living furnished employment for 40 per cent of the population. There were 20,000,000 more jobs in 1930 than in 1900.

2 Employment Near Normal *Employment* today is nearest normal in the most highly mechanized industries, such as automobile and textile manufacturing, in the paper and printing trades, and other intensely developed industries. Most *unemployment* is found today in occupations in which machines are used least.

3 New Industries Create Jobs One of every seven factory workers today is making some product unknown to his grandfather fifty years ago. One out of every four persons gainfully employed today owes his job to one of 18 new industries which have been developed since 1880. Technological advancement is responsible for employing 1,000,000 workers in manufacturing alone, and millions of others are employed producing and processing raw materials for these industries; and the handling, servicing and selling these products employs millions more.

4 Occupations Add Workers Between 1920 and 1930, the 19 principal growing occupations gained almost three times as many workers as the 19 principal vanishing occupations lost. In almost every case work in the growing occupations was less strenuous, less arduous and better paying than work in the declining occupations. This improvement has been true throughout the development of machinery. Child labor, for example, declined from one out of every five children between the ages of 10 and 15 who were working in 1900, to less than one out of 20 in 1930.

5 Few Blame Machines Only 4 per cent of about 2,500,000 unemployed persons who were studied in the Federal Unemployment Census of April, 1930, reported that they had lost their jobs on account of "industrial policy," under which the displacement of men by machines was listed as one of the several sub-classifications.

6 Machines are "Labor-Serving" Eighty-four of all machines invented are "labor-serving" and only 16 per cent have as their primary purpose the saving of labor. Most machines are invented to manufacture entirely new products. Seven-tenths of all inventions tend to increase labor's relative share of the national income.

7 Machines Need More Workers Industries which advanced most rapidly along technological lines drew most heavily upon the labor supply, while industries which were mechanized more slowly absorbed smaller portions of the available working force. This is due to the fact that machines decrease costs and prices.

8 Machines Raise Labor's Income Real wages more than doubled between 1900 and 1935, as a result of greater production. In this period production per wage-earner increased 68 per cent, but to make this increase possible manufacturers installed 331 per cent more equipment, measured in horsepower. While production of American factories increased 216 per cent between 1899 and 1929, wages paid to labor increased 479 per cent.

9 Use of Machines Raises Standards Had it been necessary to increase labor in the same proportion as production between 1900 and 1930, every adult man and woman in the nation, and several million children, would have been needed in jobs. It would have required more than 60 per cent of the entire population to provide the goods and services of a higher standard of living, whereas only about 40 per cent of the nation's population ever seeks employment.

10 Plenty For Men to Do A 75 per cent increase in the 1929 production level would be necessary to provide a "reasonable" standard of living for every family in the United States, according to the federal Bureau of Home Economics. From this it would appear that there is still plenty for both men and machines to do.

November Auto Show Increases Employment

Introduction of new automobile models in November last year instead of in January, as heretofore, resulted in more men being at work during the Fall and early Winter than in any previous year, and the high employment trend continued into January, according to the Automobile Manufacturers Association. The industry will again hold its annual show in November this year.

In the automobile and automotive parts industries an average of 453,000 men were employed through October to December, 1935. The average weekly payrolls of the combined industries in the last quarter of 1935 went to $13,741,000, or nearly double the preceding year's $7,600,000; and more than three times the depression low of $3,700,000, in the last quarter of 1932. A rise in earnings was shown.

Taylor & Fenn History Mirrors Yankee Genius

The Connecticut Yankee, his ingenuity, craftsmanship and self-reliance, is a basic theme in "A Century of Machine Tools," a booklet which tells the 101-year history of the Taylor & Fenn Co., Hartford, Conn., machine tool manufacturer.

Levi Lincoln founded the business near a dam across Little River, in Hartford, and used water power from the mill pond. The business has continued on the same site. Its order books show shipments of machine tools to foreign governments and major manufacturing plants throughout the world.

Industrial Museum Has Larger Quarters

Doubling its display space, the Museum of Science and Industry has moved into Rockefeller Center from 220 East 42nd St., New York, N. Y. The exhibit of mechanical movements, with its popular eccentric gear display, is now in the center of the rotunda, having proved to be one of the most popular features of the museum.

"Visiting" exhibits of work being done by commercial research laboratories are an added attraction of the museum. Research work of General Electric Co., B. F. Goodrich Co., Bell Telephone Laboratories, Inc., and the Eastman Kodak Co. are now being exhibited.

Heads Stamping Company

W. C. ACKLIN

Manages New G. M. Division

W. S. ROBERTS

PERSONALS

WILLIAM COLLARD ACKLIN has been elected president of the Acklin Stamping Co., 1926 Nebraska Ave., Toledo, Ohio, to succeed the late JAMES MONTGOMERY ACKLIN. Mr. Acklin became secretary of the company in 1911, and general manager in 1926. GEORGE F. MEDILL, attorney, was elected secretary to succeed Mr. Acklin. Other officers of the company are FRANK E. GRAPER, first vice-president and works manager; F. C. GREENHILL, second vice-president and sales manager, and A. E. SEEMAN, treasurer and assistant secretary.

JAMES K. DIAMOND has been appointed president of the Clipper Belt Lacer Co., Grand Rapids, Mich. He has been vice-president and general superintendent. He succeeds WILEY K. LEE, who resigned recently. RUSSELL J. CONN has been made vice-president, WILLIAM J. MERVENNE treasurer and assistant general manager, FRED V. HALLAM general sales manager, and WALTER SPERRY, superintendent. DONALD G. THAYER continues as secretary and assistant treasurer.

ROY COLE has been named chief engineer of Studebaker Corp., South Bend, Ind., and will have direct charge of all engineering, D. G. ROOS, vice-president, announced. Prior to his association with Studebaker, he was chief engineer of Dodge Brothers Corp.

VERNON R. DRUM has resigned as president of the Hupp Motor Car Corp., Detroit.

A. R. CARSON, who entered railroad work as a machinist's apprentice in 1906, has been appointed superintendent of the Canadian National Railway shops at Moncton, N. B.

W. S. ROBERTS has been appointed general manager of the new Southern California Division of General Motors Corp., Los Angeles. He has been associated with General Motors since 1922, having managed assembly plants at Atlanta, Buffalo, Baltimore and Oakland, Calif. During 1925 he spent a year in Brazil constructing and starting operation of the General Motors Export plant at Sao Paulo.

CHARLES W. BURLEY has been appointed general superintendent of Kodak Park, Eastman Kodak Co., Rochester, N. Y. He was superintendent of the Artura Co., Columbus, Ohio, which became a division of Kodak in 1909. He succeeds CHARLES K. FLINT, who has been appointed general manager.

WILLIAM C. DICKERMAN, president of the American Locomotive Co., has been reelected a director of the J. G. Brill Co., an American Locomotive subsidiary.

R. J. FITNESS, for the past two years chief engineer of the Reo Motor Car Co., Lansing, Mich., has been appointed works manager. He will continue, however, to supervise the engineering department.

STEPHEN J. KAISER, head of the production department of the Chevrolet Motor Co. at Flint, Mich., has been elected president of the Industrial Mutual Association of Flint, which has a membership of more than 30,000 of the city's factory workers.

HENRY R. HUBBARD has been elected vice-president in charge of manufacture of Electromaster, Inc., Detroit.

G. R. SHARPLEY, managing director of Ruston & Jornsby, Ltd., Lincoln, England, has been visiting heavy machinery manufacturers in this country.

CLARENCE F. WARDEN has been named assistant resident manager of the No. 2 plant at Flint, Mich., of Fisher Body Corp., filling the vacancy caused by the death of L. E. WELLS.

OBITUARIES

HIRAM PERCY MAXIM, 67, inventor and manufacturer of industrial silencing devices and mufflers, and a pioneer in electric vehicle design, died on Feb. 17 in La Junta, Col. He became chief engineer of the Electric Vehicle Co., Hartford, Conn., in 1895. He invented the Maxim silencer for firearms in 1908, organized a company to manufacture the device of which he was president for the rest of his life, and devoted much of his time to applying the same principles to industrial noise abatement devices.

FREDERIC E. WELLS, a pioneer small tool and machine manufacturer, died Feb. 11 at the age of 91 in Greenfield, Mass. He was employed by Wiley, Russell & Co. as a bookkeeper in 1869, and seven years later formed the Wells Bros. & Co. with his brother, FRANK O. WELLS. Following several mergers he became president of Goodell-Pratt Co., and in later years was one of the proprietors of the Wells Tool Co., being associated with his son, FRED W. WELLS, in this venture.

HERBERT F. PERKINS, who retired as president of the International Harvester Co. in 1931, died Feb. 1 in California. In 1899, upon graduating from Yale, he joined the Malleable Casting Co., Chicago, Ill., and soon thereafter became associated with the McCormick Harvester Co., which became the International Harvester Co. a few years later.

CHARLES V. RICH died in Detroit on Jan. 30. He was at one time factory manager of the Premier Motor Car Co., Indianapolis, Ind., later assistant superintendent of the Buick Motor Co., Flint, Mich., and master mechanic of the Motor Products Corp. of Canada, Walkerville, Ont.

PURCEL O. SEISER, 44, Fairfield, Conn., superintendent of the United States Aluminum Co.'s plant, there, died Feb. 16. Mr. Seiser was superintendent of the company's plant at Cleveland, Ohio, for two years before going to Fairfield.

OSCAR W. MUELLER, who had been a pioneer in the machine-tool industry, and who retired after 47 years in the industry as president of the Mueller Machine Tool Co., Cincinnati, Ohio, died on Jan. 31 at the age of 73.

WILLIAM C. HILL, founder of the Hill Piston Co., and Hill Automotive Service, Inc., Jackson, Mich., died February 10. He was a past-president of the Automobile Engine Builders' Association of America.

ROY JAMES KEELEY, vice-president of the Canadian Toledo Scale Co., Windsor, Ont., died on Feb. 2 after five days' illness of pneumonia.

CHARLES J. H. LAGANKE who organized the LaGanke & Sons Stamping Co., Cleveland, Ohio, died Feb. 8. He retired three years ago after more than 40 years in the stamping industry.

BUSINESS ITEMS

All USL arc welding equipment will be manufactured and sold by the Owen-Dyneto Corp., Syracuse, N. Y., J. S. FOSNIGHT, sales manager, announced. The engineering staff and machinery of the USL arc welding division have been moved from Niagara Falls, N. Y., to Syracuse. The Owen-Dyneto Corp., like the USL Battery Corp., are subsidiaries of Electric Auto-Lite Co., Toledo, Ohio, and the merging of two plants brings the manufacture of welders, motors, generators, battery charge regulators and other welding accessories together.

National Machine Tool Builders Association, Guarantee Title Bldg., Cleveland, Ohio, has moved to larger quarters at 10525 Carnegie Ave., Cleveland.

R. K. LeBlond Machine Tool Co., Madison Rd. & Edwards Blvd., Cincinnati, Ohio, has opened a direct sales office and display floor at 103 Lafayette St., New York, N. Y. Products of the machine tool division and the Cincinnati Electrical Tool division of the company will be handled at the new address, instead of at 30 Church St., New York, as heretofore. W. E. GROENE will be in charge.

Unified air express service throughout the United States has been inaugurated by 22 major airlines and the Railway Express Agency, making high-speed shipping available everywhere, with pick-up and delivery service. Nearly 500 transport planes, flown daily over 28,779 miles in this country and the facilities of the Pan American Airways, will serve shippers under the plan.

Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich., has established Eastern region sales offices in Room 816, Bush Terminal Bldg., 130 West 42nd St., New York, N. Y.

Thompson Products, Inc., 2169 Clarkwood Rd., Cleveland, Ohio, has acquired the cylinder sleeve business of the Eagle Machine Co., Indianapolis, Ind.

Bendix Aviation Corp., South Bend, Ind., has purchased the Peco Manufacturing Co., Philadelphia, Pa., which is to become a subsidiary.

Michigan Tool Co., Detroit, is putting into operation this month the new addition to its plant.

Kempsmith Machine Co., 5325 West Rogers St., Milwaukee, Wis., has been organized to take over the machine tool manufacturing business of the Kempsmith Mfg. Co., which was liquidated last year.

Feick Mfg. Co., 10225 Meech Ave., Cleveland, Ohio, has been formed by HARRY W. FEICK to manufacture sheet-metal products.

Contract Welders, Inc., 4829 Lexington Ave., has acquired Industrial Cutting Co., 4400 Perkins Ave., both of Cleveland, Ohio. The plants will be consolidated at 2545 East 79th St., in that city, on April 1.

Michigan Tool Co., 7171 East McNichol Rd., Detroit, Mich., has appointed R. S. Armstrong & Bros. Co., 676 Marietta St., Atlanta, Ga., as sales representative for its line of "Mitco" small tools for Alabama, Georgia, South Carolina and southern North Carolina.

EXPORT OPPORTUNITIES

Machinery for engraving printing type (Purchase). Mihran Sousmadjian, 6, Rue Askitou, Salonique, Greece.

Beer can manufacturing machinery (Agency). Hillegersberg, Netherlands. *203.

Elevators, 8 floors (Agency). Cairo, Egypt. *204.

Excavating machinery, highway and railroad construction equipment (Purchase). Rio de Janeiro, Brazil. *205.

Lumber carriers (Agency). Vancouver, B. C., Canada. *216.

Weighing, mixing, packing and conditioning machines (Agency). Paris, France. *216.

Bone-button manufacturing machines, automatic (Purchase). Mexico City, F.D., Mexico. *142.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office.

Corporation Reports

Company	1935 Earnings	1934 Earnings
Acklin Stamping Co.	$34,232	.....
Ainsworth Mfg. Co.	987,816	$564,237
Altorfer Bros. Co.	342,112	100,310
Blaw-Knox Co.	*550,000	35,505
Brill (J. G.) Co.	d853,401	103,214
Briggs Mfg. Co.	*9,258,046	5,121,625
Caterpillar Tractor Co.	454,134	277,957
Chapman Valve Mfg. Co.	112,965	100,716
Chicago Rwy. Equipment Co.	9,011	61,290
Chrysler Corp.	34,975,819	9,534,837
Cleveland Graphite Bronze Co.	*1,250,000	510,802
Dexter Co.	93,950	58,948
Douglas Aircraft Co., Inc.	1,262,967	38,753
Eastman Kodak Co.	.....	.....
Eureka Vacuum Cleaner Co.	245,648	318,684
Federal Mogul Corp.	209,264	102,028
Greenfield Tap & Die Corp.	99,416	85,835
Houdaille-Hershey Corp.	2,456,196	931,401
Iron Fireman Mfg. Co.	604,646	521,707
Irving Air Chute Co.	336,276	119,799
Kelsey-Hayes Wheel Co.	1,242,772	326,393

Company	1935 Earnings	1934 Earnings
Kinney Mfg. Co.	d$54,928	d$66,974
Leland Electric Co.	24,566	d59,679
Mid-West Abrasive Co.	48,487	25,826
Minneapolis-Honeywell Regulator Co.	1,793,339	1,007,785
Minneapolis-Moline Co.	170,678	d2,172,999
Monarch Machine Tool Co.	90,317	24,159
Modine Mfg. Co.	412,430	228,527
Murray Ohio Mfg. Co.	223,698	86,464
Mullins Mfg. Co.	423,781	180,504
New Haven Clock Co.	116,400	98,560
New York Air Brake Co.	d101,667	54,556
Pittsburgh Gage & Supply Co.	17,822	.....
Ross Gear & Tool Co.	245,771	248,476
Royal Typewriter Co., Inc.	1,676,571	942,229
Russell Mfg. Co.	d186,435	d523,051
Shaler Co.	80,824	76,887
Shepard-Niles Crane & Hoist Corp.	36,676	d83,416
Stutz Motor Car Co. of Amer.	d239,902	d246,545
Sundstrand Machine Tool Co.	79,149	27,872
Union Twist Drill Co.	329,104	161,973
Veeder-Root, Inc.	499,552	278,318

d—Deficit, or net loss. *Preliminary or estimated.

Diesel engines (Purchase). Riga, Latvia. *179.

Printing presses, copper plate, rotary; and typesetting machines (Purchase). Prague, Czechoslovakia. *144.

Recording instruments for steam and combustion power plants; pulverizing coal plant; machine tools; and gas producers (Agency). London, England. *182.

Woodworking machines (Exclusive agency). The Hague, Netherlands. *143.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office.

MEETINGS

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual Convention, April 20-21, Adelphia Hotel, Philadelphia, Pa. J. C. McQUISTON, manager-secretary.

MIDWEST POWER ENGINEERING CONFERENCE & MIDWEST ENGINEERING & POWER EXPOSITION. April 20-24. Palmer House and International Amphitheatre, Chicago, Ill. G. E. PFISTERER, manager, 308 West Washington St., Chicago, Ill.

NATIONAL OIL BURNER SHOW. April 14-18. Convention Hall, Detroit. G. HARVEY PORTER, managing director, Oil Burner Institute, Inc., 30 Rockefeller Plaza, New York, N. Y.

PACKAGING EXPOSITION. Hotel Pennsylvania, New York, N. Y., March 3-6, American Management Association, 330 Madison Ave., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS. Tractor & Industrial Power Meeting. April 15-16, Milwaukee, Wis.; National Production Meeting, April 21-24, Detroit, Mich.; Summer Meeting, May 31-June 6, White Sulphur Springs, W. Va. JOHN A. C. WARNER, secretary, 29 W. 39th St., New York, N. Y.

U. S. CHAMBER OF COMMERCE. Annual Meeting, April 27-30, Washington, D. C.

PATENTS

February 11, 1936

Metal-Working Machinery

Setting and Indicating Device for Geared Lathe Headstocks. Lionel A. Carter, Webster Groves, Mo. Patent 2,030,097.

Means for Cutting, Setting and Sharpening Circular Saws. Erich Poeggel, Remscheid, Germany. Patent 2,020,225.

Method and Apparatus for Handling Strands. Erwin E. Franz, Cranford, N. J., assigned to Western Electric Co., Inc. Patent 2,030,438.

Machine Tool, Particularly Milling Machine Having a Counter Support. Richard Stuhlmacher, Siegmar, near Chemnitz, Germany, assigned to Wanderer-Werke vorm. Winklhofer & Jaenicke Akt.-Ges. Patent 2,030,481.

Metal Working Apparatus. John S. Barnes, deceased, and Hope Barnes and Paul R. Guirl, Rockford, Ill., assigned to W. F. and John Barnes Co. Patent 2,030,562.

Drill Mechanism. Robert K. Jeffrey, Columbus, Ohio, assigned to the Jeffrey Manufacturing Co. Patent 2,030,636.

Tools and Attachments

Chuck. William F. Groene and George W. Luning, Cincinnati, Ohio, assigned to the R. K. Le Blond Machine Tool Co. Patent 2,030,142.

Magnetic Capping Chuck. Harry D. Smith, Buffalo, N. Y., assigned to Consolidated Packaging Machinery Corp. Patent 2,030,188.

Gaging Machine. Gauging Machine. Richard J. Brittain, Jr., Newark, and John C. Bell, Lyndhurst, N. J., assigned to General Motors Corp. Patent 2,020,237.

Jig. William A. Weightmann, Detroit, Mich., assigned to Budd Wheel Co. Patent 2,030,339.

Vernier Gage. Frank Czemba, Duluth, Minn., assigned to American Steel & Wire Co. Patent 2,030,354.

Tool for Making Snap Fasteners for Bag Frames. Edward W. Schants, Newark, N. J. Patent 2,030,406.

Testing Machine. David M. Warner, Dayton, Ohio, assigned to Tinius Olsen Testing Machine Co. Patent 2,030,418.

Penetrator-Stem for Hardness-Indicating Apparatus. Albert F. Shore, New York, N. Y. Patent 2,030,475.

February 18, 1936

Metal-Working Machinery

Grinding Machine. Raphael Atti, Union City, N. J. Patent 2,030,850.

Machine Tool. Everette K. Morgan, Rockford, Ill., assigned to the Ingersoll Milling Machine Co. Patent 2,030,888.

Control Mechanism for Machine Tools and the Like. Alexander Oberhoffken, Rockford, Ill., assigned to Ingersoll Milling Machine Co. Patent 2,030,890.

Method and Means for Spot-Welding Aluminum and Aluminum Alloys. Nelson F. Malley, Brooklyn, N. Y., assigned to Aluminum Alloys Welding Corp. Patent 2,030,906.

Cam Generating Machine. Heraclio Alfaro, Boston, Mass. Patent 2,030,907.

Automatic Chucking Machine. Arthur J. Lewis, Stratford, Conn., assigned to the Baird Machine Co. Patent 2,031,051.

Abrasive Cutting Machine and Method. Dartrey Lewis, Boston, Mass., assigned to American Chain Co., Inc. Patent 2,031,052.

Welding Machine. Edmund J. von Henke, Chicago, Ill., assigned to American Electric Fusion Corp. Patent 2,031,082.

Lathe. Charles W. Smith, Grand Rapids, Mich. Patent 2,031,135.

Boring Machine. Ray A. Miller, Port Washington, Wis., assigned to Simplicity Manufacturing Co. Patent 2,031,173.

Rotary Shear Blade Clamp. Florence C. Biggert, Jr., Crafton, Pa., assigned to United Engineering & Foundry Co. Patent 2,031,246.

Electric Arc Welding Apparatus. John P. Tripp, Montreal, Quebec, Can. Patent 2,031,288.

Roller Bearing Assembling Machine. Frank Ketcham, Dearborn, and George E. Dunn, Detroit, Mich., assigned to the Universal Products Co. Patent 2,031,417.

Tools and Attachments

Adjustable Burnishing Reamer. Robert R. Bishton, Herkimer, N. Y. Patent 2,030,846.

Inside Micrometer Centering Device. Harry C. Guelow, Elgin, Ill., assigned to the L. S. Starrett Co. Patent 2,030,864.

Apparatus for Extruding Metal. Joseph J. Schwerak, Detroit, Mich., assigned to Bohn Aluminum & Brass Corp. Patent 2,031,008.

Punch. Gustaf R. Ahlquist, Great Falls, Mont. Patent 2,031,024.

Offset Side Supported Tool Holder. Ole Stevenson, Shelton, Conn., assigned to the Apex Tool & Cutter Co., Inc. Patent 2,031,334.

Combination Precision Grinder and Calipers. Harry B. Barrett, Los Angeles, Calif.

Processes

Method of Forming Metal Containers. John F. Werder, Lakewood, Ohio, assigned to Edmund Rogers. Patent 2,031,085.

Method of Making Hinge Leaves. Earl C. Abbe, Longmeadow, Mass., assigned to Moore Drop Forging Co. Patent 2,031,244.

Machine Requirements and Industrial Construction

EQUIPMENT WANTED

Mass., Holyoke—American Writing Paper Co., Inc., 9 Main St., W. Russell, Purch. Agt.—new drives, $30,000, driers, $40,000, smoothing press, $9,000, ragwasher, $6,000, for Linden plant; water wheel, $25,000, agitators, $4,000, suction rolls, $6,000, for Nonotuck plant; power equipment, $10,000, for Porter Parson plant.

Mass., Springfield—Col. T. J. Smith, Commanding Officer, Springfield Armory, will receive bids until Mar. 3, for three motor driven bench type drilling machines, Circular 120.

Mass., Springfield—Col. T. J. Smith, Commanding Officer, Springfield Armory, will receive bids until Mar. 10, for seven horizontal surface grinders, hydraulic table reverse, hand cross feed 6x17 in., also two wet grinding attachments with pumps and motor, sediment tanks, water pipes, shut-off valves, etc., Circular 131.

Minn., St. Paul—Northern Pacific Ry. Co., 176 East 5th St., E. R. Willis, head of Purchasing Dept., plans to purchase following machine tools and machinery during 1936:

3 grinders
3 air motor hoists
10 power jacks
2 100 ton air motor jacks
2 air motor jacks
1 link grinding attachment for Micro grinder
1 road bearing boring machine
1 die sinking machine
1 high speed friction saw
1 boring tool
1 cut-off saw
1 electric hand saw
1 7½ hp. vertical electric motor
4 400 amp. electric arc welding machines
1 crane truck
1 emery grinder
1 Micro frame jaw miller
7 impact wrenches (power operated)
3 air drills

Missouri—Missouri Pacific R.R. Co., Missouri Pacific Bldg., St. Louis, S. L. Wonson, Asst. Ch. Engr.—shop equipment for main line.

Mo., St. Louis—Board of Education, 911 Locust St., G. W. Sanger, Comr. School Bldgs.—four 11 in. engine lathes, accessories and chucks, two milling machines, combination furnace, one 22 in. drill press, one arbor press and one power hack saw.

Mo., St. Louis—Simmons-Sisler Printing Co., 208 North 17th St.—two off-set printing presses.

Neb., Omaha—Omaha Steel Works, 48th and Leavenworth Sts.—oil pumps, forging equipment and miscellaneous other machine equipment.

N. Y., Jamestown—Sterling Oil Co., Emlentown, Pa., E. E. Ebner, Supt.—air compressor, electric pump, battery charging equipment, hydraulic lifts and other equipment for super-service station at 504 West 3rd St.

N. Y., Lakeville—Le Roy Salt Co., Inc., Le Roy, Spencer Carr, Pres.—transmission and conveying equipment and machinery and equipment for installation in salt mining operation here.

N. Y., Niagara Falls—Maloney Coal Co., 803 Niagara St.—coal loading and unloading machinery and transmission and conveying equipment for coal yard.

O., Canton—Board of Education, J. H. Mason, Supt.—complete vocational department machinery and equipment for vocational department of McKinley High School.

O., New London—Wheeler Broom Co., W. W. Wheeler, Mgr.—transmission and conveying equipment, saws, binding machine and other equipment for manufacture of brooms.

Pa., Erie—J. A. Zurn Mfg. Co., 1401 German St.—machinery and equipment for the manufacture of plumbing supplies.

Pa., Montoursville—Lycoming Barrel Corp., G. S. Clampitt, Pres. and Genl. Mgr.—three barrel stave manufacturing machines.

Pa., Peckville—Angelo Marsidi, 1009 South Pleasant Ave.—machinery, transmission and conveying equipment, etc., for coal mining development on Dolph Tract near Jessup, Pa.

Pa., Philadelphia—Ralph Kennedy, 111 North 7th St.—band saw and other woodworking machinery, including lathe, planer, etc.

Alta., Vegreville—Vegreville Observor Co.—printing machinery.

N. B., Bathhurst—Bathhurst Power & Paper Co., Ltd.—machinery for the manufacture of folding box boards.

Ont., Pembroke—E. B. Christiansen of Service Press, 247 Pembroke St. W.—printing presses and accessories.

Ont., Stoney Creek—Parry Sound Basket & Veneer Co.—woodworking machinery.

OPPORTUNITIES FOR FUTURE BUSINESS

Calif., Oakland—California Cotton Mills, Railroad Ave. and Kennedy St., have awarded separate contracts for improvements to their plant. Estimated cost $100,000.

Calif., Vernon — Technicraft Co., 407 East Pico Blvd., Los Angeles, has awarded the contract for a 1 and part 2 story, 50x140 ft. factory. Estimated cost $40,000.

Conn., Milford—Vincent Gaetano & Sons, Post Rd., is having plans prepared by P. P. Petrofsky, 955 Main St., Bridgeport, for a 1 story shop building for the manufacture of wrought iron, aluminum and brass products. Estimated cost $37,000.

Ill., Chicago—American Can Co., 230 Park Ave., New York, N. Y., has acquired the plant at Union Stock Yards formerly occupied by Libby, McNeill & Libby, and will improve same for its own use. Estimated cost to exceed $37,000.

Ill., Chicago—Odman Paper Co., 123 West Austin St., plans to rebuild its plant recently destroyed by fire. Estimated cost will exceed $50,000.

Ind., Anderson—D. and L. Machine & Welding Co., 16th and Brown Sts., is building an addition to its plant and will require additional tools and machinery.

Ind., Anderson — Howe Fire Apparatus Co., Ames and Crystal Sts., North Anderson, will rebuild its factory recently destroyed by fire. Estimated cost $37,000. B. Howe, Pres.

Ind., Gary—Carnegie-Illinois Steel Co., Carnegie Bldg., Pittsburgh, Pa., plans to construct a normalizing unit for its steel rail mill here. Estimated cost $500,000.

Ind., Muncie—Muncie Gear Co., Muncie, plans to construct a 75x150 ft. addition to its plant to be used for the manufacture of stokers. Estimated cost including equipment $37,000.

Me., Camden—Hughes Woolen Mill, Camden, contemplates repairs and alterations to its mill. Estimated cost including equipment $37,000.

Mass., Salem — Hygrade Sylvania Corp., 60 Boston St., W. E. Poor, Vice-Pres., manufacturer of radio tubes, has awarded the contract for a 2 and 3 story factory on Loring Ave. Estimated cost $100,000.

Mich., Ironwood—Globe Publishing Co., Ironwood, is having plans prepared by J. W. Thomas, Archt., Standard Bldg., Cleveland, O., for the construction of a 2 story, 40x61 ft. printing plant. Estimated cost $30,000.

Mich., Royal Oak—Chase Tool Co., Royal Oak, plans improvements to its plant. Estimated cost including equipment $37,000.

Miss., Hazelhurst—Jenkins Lumber Co., Hazelhurst, has awarded separate contracts for the construction of a planing mill and lumber plant. Estimated cost including equipment $37,000.

Mo., Kansas City—Simmons Co., 230 Park Ave., New York, N. Y., manufacturer of furniture, plans alterations and improvements to its factory here. Estimated cost $60,000. C. E. Keyser, Merriam Bldg., Kansas City, Archt.

N. Y., Arcadia—K. R. Wilson Foundry Co., Liberty St., plans to rebuild its assembly plant recently destroyed by fire. Estimated cost will exceed $100,000.

N. Y., Auburn—Dept. of Correction, State Office Bldg., Albany, is having plans prepared by W. E. Haugaard, Archt., State Office Bldg., for the construction of a maintenance shop building. Estimated cost $90,000.

N. Y., Syracuse—International Harvester Co., 606 South Michigan Ave., Chicago, Ill., has awarded the contract for the construction of an addition to its plant on Teale Ave. Estimated cost $105,000.

N. C., Charlotte—Johnston Mills, Charlotte, have awarded the contract for an addition to their mill. Estimated cost $60,000.

O., Cleveland—Clark Controller Co., 1146 East 152nd St., P. C. Clark, Pres., has awarded the contract for an addition to its factory. Estimated cost $40,000.

O., Cleveland—Industrial Rayon Corp., West 98th St. and Walford Ave., J. P. McGervey, Purch. Agt., is having plans prepared by Christian, Schwarzenberg & Gaede Co., Archts. and Engrs., 1836 Euclid Ave., for 2 and 3 story additions to its factory. Estimated cost $750,000.

O., Cleveland—McKinney Tool & Mfg. Co., 1688 Arabelle Rd., is receiving bids for an addition to its factory. Estimated cost $40,000. E. G. Hoefler, 5005 Euclid Ave., Engr.

O., Massillon—Eaton Mfg. Co., C. F. Ochs, Pres. and Genl. Mgr., manufacturer of auto accessories, has awarded the contract for alterations to its factory, including a new boiler house. Estimated cost $50,000.

O., Sebring—H. Bettis Co., Zanesville, manufacturer of containers, plans alterations and improvements to its plant. Estimated cost including equipment $37,000.

O., Warren—Republic Steel Corp., Union Trust Bldg., Cleveland, plans improvements to its cold rolling mill and steel finishing plant. Work will be done by separate contracts. Estimated cost $500,000.

Ore., Portland—Iron Fireman Mfg. Co., 4784 S.E. 17th St., plans improvements to its factory. Estimated cost will exceed $40,000.

Ore., Portland—Fields Motor Co., 107 Grand Ave. S.E., plans to construct a 2 story shop and garage addition. Estimated cost $37,000.

Pa., Altoona—Brumbaugh Body Co., 3031 6th Ave., C. Brumbaugh, Pres. and Mgr., has purchased the property and buildings at Plank Rd. and Logan Ave., Llyswen (Altoona P. O.), and will rehabilitate same and install new equipment for the manufacture of auto bodies.

Pa., Catasauqua — General Mills, Inc., 1151 Front St., has awarded the contract for an addition to its silk mill. Estimated cost $35,000.

Pa., Clairton—Carnegie-Illinois Steel Co., Carnegie Bldg., Pittsburgh, has awarded the contract for the construction of a hot vapor phenol recovery plant at the Clairton by-products works.

Pa., Philadelphia—Crown Cork & Seal Co., Easton Ave. and Kresson Sts., Baltimore, Md., has taken over the plant formerly occupied by the Acme Can Co., and will improve and build additions to same to be used as a can manufacturing plant for its own use. Estimated cost $3,000,000. Bids are now being received on general and separate contracts.

Pa., Uniontown—Dudley Electric & Machine Co., Uniontown, plans to rebuild its factory recently destroyed by fire. Estimated cost $50,000.

Tenn., Memphis — Indian Flour Co., Linden Ave. and Southern Ry. tracks, plans to alter storage plant into a plant for the manufacture of cotton and burlap bags. Separate contracts have been awarded for the work. Estimated cost including equipment $37,000.

N. B., Milltown—Excelsior Co. of Canada, Ltd., St. John, E. R. Mellenger, Pres., plans to construct a wood product plant here. Estimated cost $40,000.

N. B., St. John—Hadley Mfg. Co., St. John, plans to construct a plant for the manufacture of building materials. Estimated cost $80,000.

Ont., Guelph—Guelph Foundry Co., Wellington St., is having plans prepared for an addition to its foundry.

Que., Quebec—Kirouac Toy Co., Febrique St., contemplates the construction of a factory and storage building. Estimated cost will exceed $40,000.

American Machinist — REFERENCE BOOK SHEET ©

Chromium Steels (Sheet, Strip and Plate)

The American Society for Testing Materials published in 1935 the "Tentative Specifications for Corrosion-Resisting Chromium Steels (Sheet, Strip and Plate)." The tentative standard A 176 is reproduced in its entirety, in two parts

Scope

1. These specifications cover soft corrosion - resisting chromium steel sheet, strip and plate. The terms sheet, strip and plate as used in these specifications apply to the following:

Sheet includes products less than $\frac{3}{16}$ in. in thickness and 24 in. and over in width.

Strip includes both hot-rolled and cold-rolled strip as follows:

Cold-Rolled Strip includes material under 24 in. in width.

Hot-Rolled Strip includes material 0.175 in. and less in thickness, and under 24 in. in width.

Plate includes material $\frac{3}{16}$ in. and over in thickness.

Process

2. The steel shall be made by the following processes: electric-arc, electric-induction.

Discard

3. A sufficient discard shall be made from each ingot to insure freedom from injurious piping and segregation.

Chemical Composition

4. The steel shall conform to the requirements given in Table I.

Ladle Analysis

5. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of the elements specified in Section 4. The analysis shall be made from drillings taken at least ¼ in. beneath the surface of a test ingot made during the pouring of the melt. The chemical composition thus determined shall be reported to the purchaser or his representative, and conform to Sect. 4.

Check Analysis

6. If check analysis is specified by the purchaser, it shall be made from drillings or millings as taken from the finished material or from a broken test specimen. The chemical composition thus determined shall conform to Section 4.

Physical Properties

7. (*a*) When specified by the purchaser, the material shall conform to the requirements given in Table II as to physical properties.

(*b*) The yield point shall be determined by the dividers method.

Bend Tests

8. (*a*) The bend test specimens shall stand being bent cold through the required angle without cracking on the outside of the bent portion.

(*b*) Material up to and including ⅜ in. in thickness shall be bent around a pin the diameter of which is equal to the thickness of the material.

(*c*) Plates over ⅜ in. in thickness shall be bent around a pin the diameter of which is equal to twice the thickness of the material.

(*d*) Axis of the bends shall be parallel to the direction of rolling.

Test Specimens

9. (*a*) Tension test specimens shall be taken from finished material and shall be in the longitudinal direction. The tension specimens shall be of the full thickness of the material and shall conform to the dimensions shown in Fig. 1, except for plates ¾ in. and over in thickness, in which case the test specimens shall be machined to the form and dimensions shown in Fig. 2.

(*b*) Bend test specimens from sheet and strip less than $\frac{3}{16}$ in. in thickness shall be the full thickness and shall have a width equal to six times the thickness but not less than 1 in. The length shall be equal to the width of the sheet or strip, but in no case longer than 12 in. The edges of the test specimens may be rounded to a radius equal to one-half the thickness.

(*c*) Bend test specimens taken from plates shall be of the full thickness of the material up to and including ½ in. in thickness, of a suitable length, and between 1 and 2 in. in width. The sheared edges shall be removed to a depth of at least ⅛ in. and the sides shall be smoothed with a file. The corners of the cross-section of the specimen may be broken with a smooth file, but no appreciable rounding of corners will be permitted. In the case of plates over ½ in. in thick-

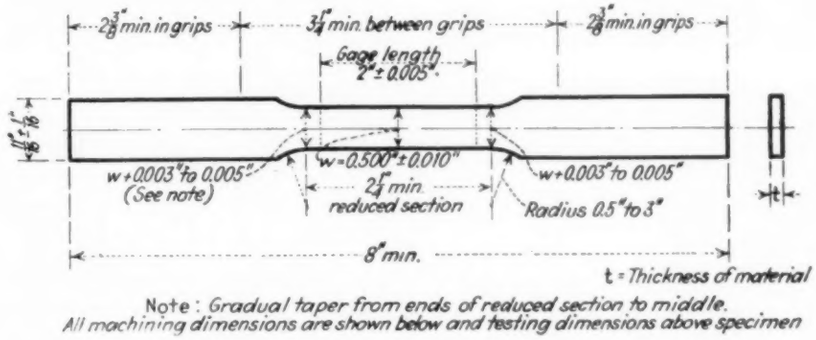

2⅜" min. in grips
3¼" min. between grips
2⅜" min. in grips
Gage length 2" ± 0.005"
w + 0.003" to 0.005" (See note)
w = 0.500" ± 0.010"
2¼" min. reduced section
w + 0.003" to 0.005"
Radius 0.5" to 3"
8" min.
t = Thickness of material
Note: Gradual taper from ends of reduced section to middle.
All machining dimensions are shown below and testing dimensions above specimen

Fig. 1.—Standard Tension Test Specimen for Sheet and Strip Metals

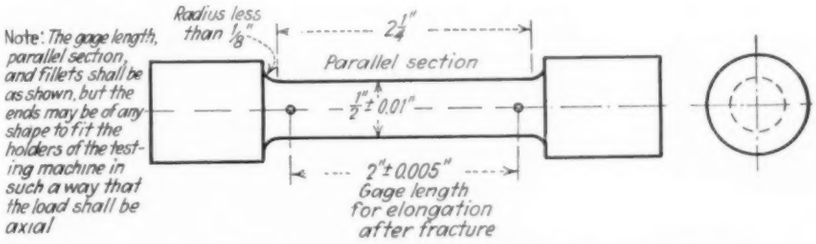

Note: The gage length, parallel section, and fillets shall be as shown, but the ends may be of any shape to fit the holders of the testing machine in such a way that the load shall be axial
Radius less than ⅛"
2¼"
Parallel section
½" ± 0.01"
2" ± 0.005"
Gage length for elongation after fracture

Fig. 2.—Standard 2-in. Gage Length Tension Test Specimen

Chromium Steels (Sheet, Strip and Plate)

ness, machined specimens as described in Paragraph (*d*) shall be used.

(*d*) Machined bend test specimens shall be 1 by ½ in. in cross-section and at least 6 in. in length. The edges may be rounded to a $\frac{1}{16}$-in. radius. When permitted by agreement between the purchaser and the manufacturer, the cross-section may be modified to ½-in. square. The center of the cross-section of the test specimen shall be half way between the center and outer surface of the plate, unless otherwise specified.

(*e*) Hardness tests may be made on the ends of the tension specimens, as far as possible from the gage length, before they are tension tested.

Number of Tests

10. Two tension tests, two hardness tests, and one bend test shall be made on each lot of material, a lot consisting of 100 or less each of sheets, strips or plates, and in no case less than 1,000 lb. from the same melt of steel and the same specified thickness.

Special Tests

11. If any special tests are required which are thought to be pertinent to the intended application of the material ordered, they shall be as agreed upon between the purchaser and the manufacturer or as specified.

Physical Tests

12. In making physical tests reference should be made to the following methods of test of the American Society for Testing Materials:

(*a*) *Tension Tests* — Standard Methods of Tension Testing of Metallic Materials (A.S.T.M. Designation: E 8).[1]

(*b*) *Brinell Hardness* — Standard Methods of Brinell Hardness Testing of Metallic Materials (A.S.T.M. Designation: E 10).[2]

(*c*) *Rockwell Hardness*—Tentative Methods of Rockwell Hardness Testing of Metallic Materials (A.S.T.M. Designation: E 18 — 33 T).[2]

Designation of Finish for Sheets

13. The various types of finish procurable on sheet products shall be as follows:

No. 1 Finish—Hot rolled, annealed and pickled.

No. 2D Finish—Full finish (Dull).

No. 2B Finish—Full finish (Bright cold rolled).

No. 4 Finish—Standard polish, one or both sides.

No. 6 Finish—Standard polish, Tampico brushed, one or both sides.

No. 7 Finish—High lustre finish.

No. 8 Finish—Mirror finish.

The remainder of the tentative standard will appear in a following number.

[1] 1933 Book of A.S.T.M. Standards, Part I, p. 949.
[2] *Ibid.*, p. 942.
[3] See p. 1377.

Table I.—Chemical Composition

	Type	Carbon, max., per cent	Manganese, max., per cent	Sulfur, max., per cent	Phosphorus, max., per cent	Silicon max., per cent	Chromium, per cent	Nickel, max., per cent
Grade 1	403	0.12	0.60	0.030	0.030	0.75	11.50 to 13.00	0.60
Grade 2	410	0.12	0.60	0.030	0.030	0.75	12.00 to 14.00	0.60
Grade 3	425	0.12	0.60	0.030	0.030	0.75	14.00 to 16.00	0.60
Grade 4	430	0.12	0.50	0.030	0.030	0.75	16.00 to 18.00	0.60
Grade 5	442	0.35	0.50	0.030	0.030	0.75	18.00 to 23.00	0.60
Grade 6	446	0.35	0.50	0.030	0.030	0.75	23.00 to 30.00	0.60
Grade 7	Special	To provide for special properties, variations in chemical composition from that shown in Grades 1 to 6 inclusive, will be permitted.						

Table II.—Physical Properties

	Tensile Strength, min., lb. per sq.in.	Yield Point, min., lb. per sq.in.	Elongation in 2 in., min., per cent	Brinell Hardness, max.	Rockwell Hardness, max., (B Scale 100-kg. load, $\frac{1}{16}$-in. ball)	Cold Bend, deg.[b]
Grade 1	70 000	35 000	25.0[a]	202	88	180
Grade 2	70 000	35 000	25.0[a]	202	88	180
Grade 3	70 000	35 000	25.0[a]	202	88	180
Grade 4	70 000	35 000	22.0[a]	202	88	180
Grade 5	75 000	40 000	20.0	202	95	180
Grade 6	75 000	40 000	20.0	217	95	135
Grade 7	Dependent upon the chemical composition specified and to be as mutually agreed upon between the purchaser and the manufacturer.					

[a] Material 0.050 in. and under in thickness (U. S. Standard No. 18 gage and under) shall have a minimum elongation of 20.0 per cent.
[b] See Section 8.

Table III.—Dimensional and Weight Tolerances of Sheet

No. 1 and No. 2 Finishes.
Weight Tolerances Only to Apply on Polished Finishes.

THICKNESS TOLERANCES

Ordered Thickness, in.	Tolerance, Plus or Minus, in.
0.005	0.001
0.006 to 0.007	0.0015
0.008 to 0.0160	0.002
0.0161 to 0.026	0.003
0.027 to 0.040	0.004
0.041 to 0.058	0.005
0.059 to 0.072	0.006
0.073 to 0.083	0.007
0.084 to 0.098	0.008
0.099 to 0.114	0.009
0.115 to 0.130	0.010
0.131 to 0.145	0.012
0.146 to 0.176	0.014

WIDTH AND LENGTH TOLERANCES[a]

Width	Tolerance	
	Plus	Minus
Up to 42 in.	$\frac{1}{32}$ in.	0
42 in. and over	$\frac{1}{8}$ in.	0
Length		
Up to 120 in.	$\frac{1}{32}$ in.	0
120 in. and over	$\frac{1}{8}$ in.	0

WEIGHT TOLERANCES

The actual weight of any one item of an ordered thickness and size in any finish is limited in overweight by the following tolerances:

	Tolerance Actual Weight Over the Estimated Weight[b]
Any item of 5 sheets or less, or any item estimated to weigh 200 lb. or less	10 per cent
Any item of more than 5 sheets, and estimated to weigh more than 200 lb.	7½ per cent

There is no under tolerance in weight for No. 1 and No. 2 finishes, these finishes being limited in under tolerance only by the permissible variations in thickness. Polished sheets may actually weigh as much as 5 per cent less than the estimated weight.[b]

[a] Sheet 0.131 in. and over in thickness, regardless of size, may have permissible variations of $\pm\frac{1}{4}$ in. in width and in length, respectively.
[b] For determining estimated weight the following factor shall be used:
Straight chromium stainless steel sheets ..... 41.2 lb. per sq. ft. per inch thickness

The Round Table

HOME TALENT

"Bill Saunders tells me you're sending him quite a lot of work lately, Al. Are we getting too busy to do our own hardening and tempering or do you just feel sorry for Bill and want to help him out?"

"Neither, Ed. I'm sending Bill more work because I find it pays us, and I hope it pays Bill, too."

"What's the matter with keeping the work at home, Al? We might better have our men do our heat-treating than to send it out."

"I had that idea myself, Ed, and we used to do almost everything. But we lost too many tools in hardening, so I tried sending some out. I'm going to send more as time goes on."

"You used to be quite a tool hardener yourself, Al, but you must be losing your grip. Or don't you like the heat any more?"

"Maybe I am losing my grip a bit on hardening, Ed. You can't spend most of your time keeping the shop moving and still keep up to date on all the new steels and heat-treating methods."

"Can't someone else do it? You must have some good men in the shop, Al."

"Sure I have, Ed—a lot of 'em. But they aren't supposed to be expert heat-treating men. We're using more kinds of steel than we used to so as to get the best results. The more kinds we use the more we need expert heat-treating service."

"And you think Bill Saunders knows all about them, when you don't?"

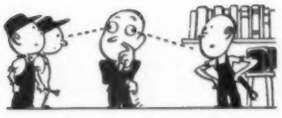
"Not all, Ed, but he knows a lot more than we do. That's his job. He keeps posted on the new steels and how to handle them. If there's one operation where you need a specialist it's in heat-treating steel."

"That sounds fine, Al, but how do we benefit?"

"Two ways, Ed. The cost of heat-treating and the losses in hardening are both lower than when we tried to do it all."

"Couldn't you use fewer kinds of steel and get some special heat-treating equipment?"

"Of course, we could, but I don't believe either would pay. We don't have enough of such work to warrant spending the money for equipment. And we don't want to handicap ourselves by sticking to old steels when there are better ones to be had."



"I don't like the idea of being dependent on someone else. We ought to be self-contained."

"That's another crazy idea, Ed. None of us are 'self-contained' as you call it. If we were we'd make our own power, our own steel and our own machine tools. Shops used to make their own tools, set-screws and everything else they could. We began to advance when we began to specialize."

Is Al right in using a specialist for such work as heat-treating? Or would he be better off by giving these jobs to his own men?

DISCUSSION

New Tricks

Al is right in objecting to so much instruction of men by the new foreman. While an outsider might see ways of improving some of the methods, it is unbelieveable that all of the methods now in use need changing and improving. The only time when the foreman is justified in insisting on the men following exact instructions is when the job or piece is new to the worker and the foreman is the only one who has previously acquired any knowledge of the part or process. For example, if the foreman is the only one familiar with the workings of a new machine, he should insist that the operator follow his instructions. In general, the machinist will work out the easiest way, because man is both lazy and ingenious.

I can foresee plenty of grief for both Al and his foreman in the lowering of the shop morale caused by this meddling. An executive is judged by the results he obtains. An intelligent foreman will rate his machinists the same way. When the cost figures begin to roll in Mr. New Foreman is due to hunt a job as a machinist because he will have proved himself incompetent as an organizer and coordinator of the work and a waster of potential shop brains. —E. E. Gagnon.

Concrete Floors

Concrete floors are a bone of contention that never seem settled satisfactorily to employer and employee

alike. There is no doubt that many men request boards to stand on without any thought to the question of health or fatigue, but purely because they believe it to be their inalienable right.

A noted scientific laboratory made a searching inquiry into this question some time ago, and its report was that in the majority of cases examined the percentage of fatigue measured between operators standing on boards and those standing on concrete was less than 6 per cent. But there are always special cases where the boards are invaluable, such as heavy arbor-press work and lifting heavy castings on and off machines, where there is little doubt but that the springiness of the boards relieves the operator's body from the heavy strain that would result from standing on a solid surface.

As to the warmth of concrete floors, there are too many operators in machine shops who have formed the habit of wearing thin-soled shoes, or sneakers. If they wore proper shoes their foot warmth would be taken care of automatically.

This question can not be solved by "Yes" or "No," but calls for the exercise of a little judgment and a knowledge of what the employee's work involves. —CHARLES R. WHITEHOUSE,
Electrical Engineer,
Waltham Watch Company.

Purchased Parts

Increasing the fixed charges of Al's plant beyond the requirements of what may be considered the regular volume of business should certainly be avoided.

With the increasing loads that are almost certain to fall upon management and manufacturing enterprises, it will be necessary to look to every economy. As a matter of industrial principle it may be found better to build and equip plants to meet the requirements of medium expected rate of production only. With the possibilities of modern lighting and with the proper training of key workmen, it should be practicable to organize for a second shift when the demands of business require increased production.

I believe that the purchase of completed component parts is entirely feasible. A study of the product should make possible the arrangement of sensible specifications to control the quality of materials. Drawings of the required parts, dimensioned in accordance with well-known limit systems will show clearly all permissible tolerances and make inspection relatively easy.

Many local outside shops will be anxious to secure the work and will probably make favorable quotations. From the standpoint of stable employment, purchasing parts is a move in the right direction and a manufacturer will definitely know the cost of such parts. Al should proceed with the plan he proposes. It has many possibilities.

—H. E. BROOKMAN,
Associate Professor of Applied Science,
University of South Dakota

Under present conditions Al would be wise in having some of his work made outside. Enlarging his plant will tie up some of his liquid assets. It would also add to his overhead, and if business falls off he would have a larger plant on his hands than he needs.

In letting out work, however, he should be wary of quotations that seem too low, since such bidders are likely to supply inferior work.

When asking for bids, Al should let it be understood that the successful bidder will be given the contract so long as his work is satisfactory. By doing this he will give the supplier longer time in which to amortize the cost of the necessary special tooling, and should receive better prices.

When the contract is to be let, Al should make sure of two things. First, that all blueprints and specifications are correct, clear and concise and without chance of being misunderstood. Second, he should have a competent inspector to check the work as it is received.

Under these conditions I think Al should get good results and will perhaps find it cheaper than making the parts in his own shop. Later, if business should improve he can enlarge his plant if it seems advisable.

—THOMAS M. GARRY,
Instructor, Yale & Towne
Apprentice School.

Extra Dividends

Paying extra dividends and cutting melons are just what ruin an industry, cause unemployment at the first slack moment and leave the stockholders high and dry when they most need the money. And this on top of not being able to buy new equipment when needed to reduce costs and meet competition.

While enterprise after enterprise skipped dividends and retrenched in every way during the depression, Am. Tel. and Tel. kept right on paying its regular dividend of nine per cent, just because a wise management salted away a surplus year after year when others dissipated their earnings by cutting melons for their stockholders, many of whom now have no stock to hold.

This is a lesson that has received nation wide notice and is the best answer to the question of having a good reserve above depression requirements.

—J. C. P. BODE.

What About Vacations?

The greatest drawback in closing down the whole plant to permit all vacations to be taken at the same time is that nearly all plants would close during the first or the second week in August when the travel and holiday facilities are congested and more expensive, with the result that many of the employees would stay at home.

A proper vacation that is to do the maximum good means freedom from everyday work and a change of air and environmenf. It also has relationship to accident prevention, as a man who never has a vacation is much less alert than one who has.

To arrange vacations so that there will be as little interference with the work as is possible, it is necessary to make a schedule in advance of the vacation season. The superintendent or the foreman will know how many men in each department can be spared at one time. In letting the men choose their own times for vacations, the choice should go by seniority of service.

—W. E. WARNER,
Bromley Common, Kent, England.

Yearly Wage

The idea of a yearly wage would bring to many employees a greater sense of their value if such an ideal were realized. Under present industrial and economic conditions, however, such a scheme is impossible of application. Production has made rapid progress in the past few years without a corresponding expansion in the means of distribution and consumption. This has led to periods of inflation and overproduction with subsequent periods of depression.

How to plan industries in order to smooth out the peaks in production and at the same time increase purchasing power to a sufficient extent to consume the evergrowing output of the machine age seems to be of more importance at the moment than any further increase in productive goods. Unless many fundamental changes are made, there can be no prospect of any radical alteration in the present method of remunerating the weekly wage earner. —W. L. WATERHOUSE,
Bristol, England.

Ideas FROM PRACTICAL MEN

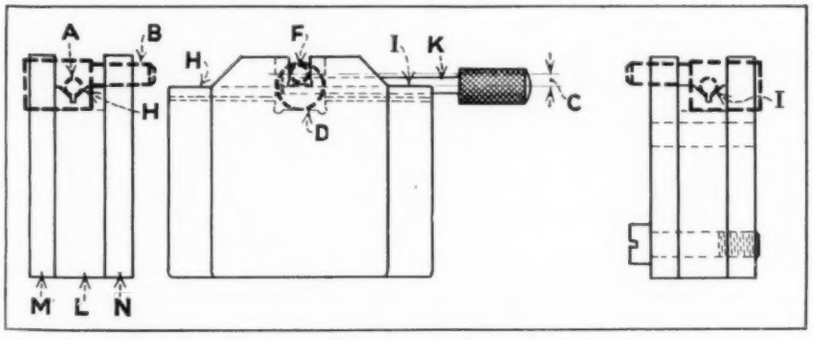
Crosshole Location in Offset Work

FRANK HARTLEY

A rather troublesome problem in gaging that presented itself is shown in the illustration. The work, indicated by heavy dotted lines, has a crosshole at *A*, the location of which is to be gaged relative to the offset end *B*, of the work and, within certain limits, regarding the center *C*, of the large end of the work. The distance of the hole from the shoulder is not important. The hole has been previously checked for diameter, so that it is necessary only to check it for location.

The larger diameter of the work is located in the slot *D*, while the offset portion is located in slot *F*, the work being held down by hand in contact with the bottoms of the slots. In opposite sides of the fixture at *H* and *I* are V-grooves varying slightly in depth and which serve to hold the gaging pin *K* in proper relation to the work. The diameter of the gaging pin is enough smaller than that of the hole so that when it is held down in either of the V-grooves and is pushed up to the work it will enter the hole freely from either side if the hole is located within the required limits. But if the gaging pin should enter the hole from one side only, or should not enter it from either side, it is evident that the hole is not located within the required limits. The gaging pin is slightly chamfered on the end so that it will readily find the hole.

In making this gaging fixture, it was found convenient to make it in three parts, *L*, *M* and *N*, to permit the various surfaces to be ground before assembly.



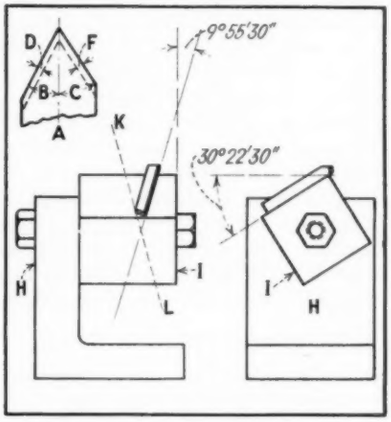
The location of the crosshole in relation to the axial center of the large end of the work is gaged by a gage pin held in V-grooves in opposite sides of the fixture

Grinding Compound Angles

J. H. BOULET, JR.

Toolmakers are often confronted with the problem of grinding compound angles and sometimes do not know just how to proceed.

Assume that the form tool shown at *A* in the illustration is to be ground, the tool being for cutting a V-groove having flanks at unequal angles. Angle *B* is 30 deg. while angle *C* is 36 deg. The clearance angles *D* and *F* are each 5 deg. The fixture for holding the tool is an angle plate *H* having the block *I* rotatably mounted on its vertical face.



Work can be positioned for grinding a compound angle at one setting by the formulas given

For grinding angles *B* and *D* at one setting, the tool is clamped to the block at an angle to be found as follows:

$$\frac{\tan 5 \text{ deg.}}{\sin 30 \text{ deg.}} = \frac{0.08749}{0.5} = 0.17498$$

$$= \tan 9 \text{ deg. } 55 \text{ min. } 30 \text{ sec.}$$

The block is then rotated to an angle to be found as follows:

$$\frac{\tan 30 \text{ deg.}}{\text{Cos } 9 \text{ deg. } 55 \text{ min. } 30 \text{ sec.}} = \frac{0.57735}{0.985035}$$

$$= 0.58612 = \tan 30 \text{ deg. } 22 \text{ min. } 30 \text{ sec.}$$

The setting for grinding the angles *C* and *F* is found by the same process, substituting 36 deg. for 30 deg. in both formulas. However, the tool is set on the block in the reverse position to that for grinding angles *B* and *D*, as indicated by the dotted line *KL*. In setting the tool on the block and in rotating the block to the required angle, either a protactor or a sine bar can be used, depending upon the degree of accuracy required.

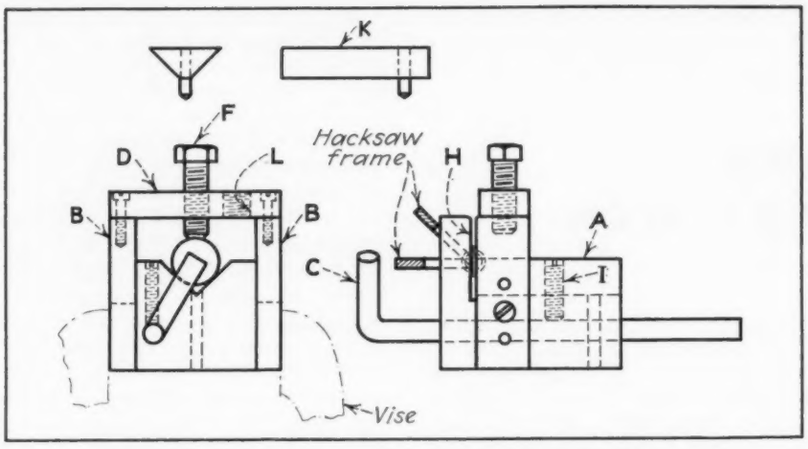
Cutting-Off Fixture

JOHN A. HONEGGER

It is often necessary to cut off several pieces with a hacksaw, all of which are to be of the same length and to have the ends square with the axis. If the ends are not square, more than the required amount of stock must be removed to square them.

In the illustration is shown a fixture for cutting off round, square or flat stock to the required length, leaving the ends square. It will accommodate round stock from ⅛ to 1 in. in diameter, or to its equivalent in either square or flat stock, and is made to be held in a bench vise.

Essentially, the fixture consists of the hardened V-block *A*, the side pieces *B*, the adjustable stop *C*, the strap *D* and the clamping screw *F*. The side pieces are cold-rolled steel, cyanided and are cut away at *H* to leave openings, or slots, between them and the sides of the V-block for guiding the hacksaw blade. Stop *C* is held in place by the setscrew *I*, and strap *D* reaches across the tops of the side plates and carries the clamping screw, which is



The fixture is held in the bench vise and is provided with slots to guide the hacksaw blade so that pieces cut off will be square with the axis

positioned in the center for clamping either round or square stock. For clamping flat stock, the filler piece *K* is inserted in the opening in the V-block and the clamping screw is transferred to the tapped hole *L*.

Index Fixture for Boring or Internal Grinding

ALBERT MANHARTSBERGER

In the illustration is shown an indexing fixture for boring or grinding two holes at accurate center distance in the work indicated by heavy dotted lines.

Essentially, the fixture consists of the baseplate *A;* the disk *B;* the clamping plate *C;* the hardened plate *D;* and the index pin *F*. The baseplate has tapped holes for attaching it to the faceplate of the machine by screws from the back. Disk *B* is eccentrically nested in the baseplate. It carries the hardened plate *D* and can be rotated on a central stud.

In use, the work is placed on the hardened plate and is located by pins *H* and *I* engaging previously drilled holes. Pin *H* is round, while pin *I* is slabbed on opposite sides so that its section is diamond shaped. The function of such a pin is so well known to toolmakers as to need no explanation.

The work is clamped to the hardened plate by clamps *K*, after which the screws *L* are tightened, pinching the disk between the clamping plate and the baseplate. After the first hole has been bored, screws *L* are loosened, the index pin is withdrawn and the disk is rotated 180 deg. as indicated by the coincidence of one of the lines *M* on the disk and the line *N* on the clamping plate. The index pin is engaged in bushing *O* and the clamping plate is tightened on the disk by the clamping screws. The work is thus held in position for boring the second hole.

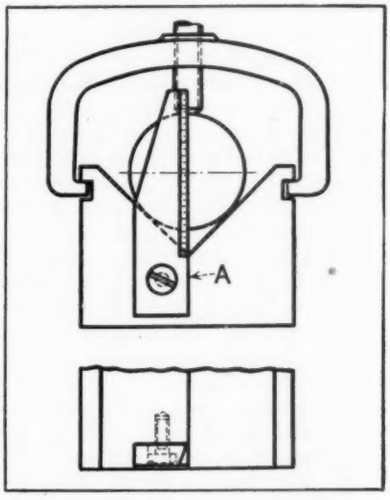
Counterweight *P* is to balance the disk with the work in place and also to take the strain off of the index pin. If the fixture as a whole is out of balance, counterweight *S* is attached to the clamping plate. Accurate balancing of the disk itself and the fixture as a whole will reduce vibration to the minimum and insure smooth working, especially when the fixture is used on the grinder and revolves at comparatively high speed. Any runout of the fixture can be checked by placing the contact point of an indicator in the groove in the periphery of the baseplate.

A Centering V-Block

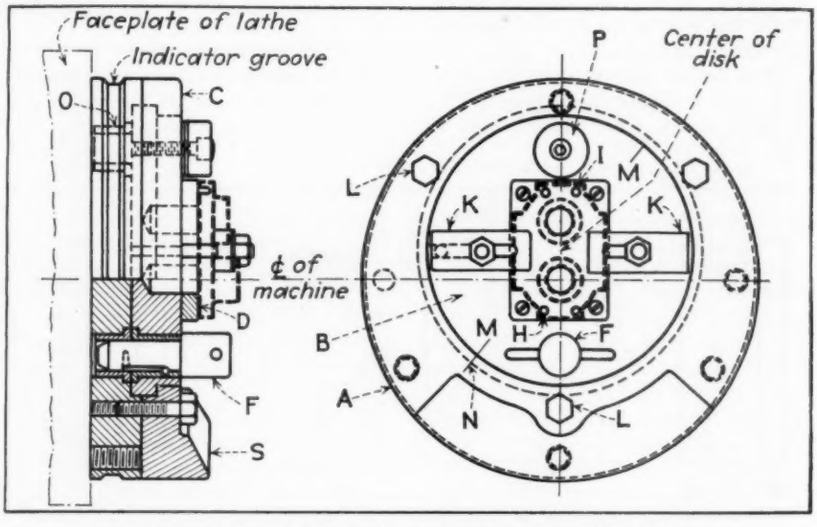
WILLIAM M. HALLIDAY
Baildon, Yorkshire, England

In the illustration is shown a V-block designed for ease in laying-out and setting-up round work. Besides the usual clamp and screw it has the vertical gage *A* let into the end. The gage is graduated to show the centers of round work of various diameters, so that it is a simple matter to locate and mark the center of work resting in the block. The graduated edge of the gage is in the center of the Vee and is beveled to permit easy and accurate scribing.

The device can be used as a center square. After a line has been scribed



The vertical gage is let into the end of the V-block. It has a beveled edge graduated to show the centers of round work of various diameters



Eccentricity of the disk in the fixture is equal to one-half the center distance of the holes to be bored. More than two holes can be bored by providing additional holes for the index pin

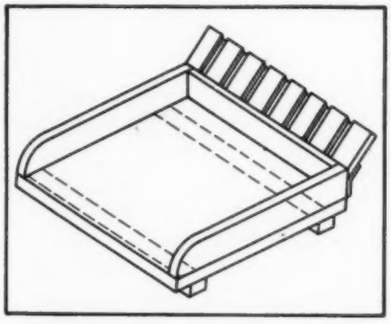
on the end of the work, the work can be rotated approximately 90 deg. and another line scribed. These two lines will then be at an angle of 90 deg. to each other and their intersection will be the center of the work. On fairly large work that would require much time and trouble in setting up preparatory to centering, this V-block will be found very convenient.

Rack for Toolbits

C. F. FITZ

Illustrated is a convenient rack having grooves for various toolbits. It is attached to the back of the regular lathe toolboard by angle irons and can be set to the desired angle by bending the angle irons to suit.

Toolbits placed in the rack are in plain view at all times. Such a rack is a great convenience for the operator.



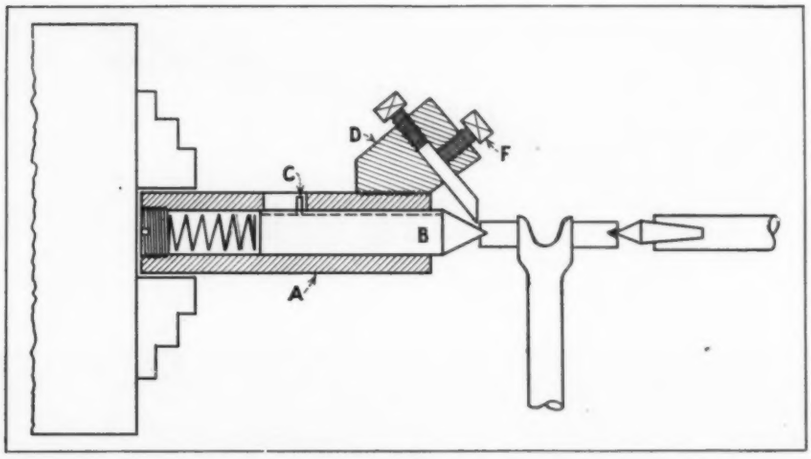
Toolbits placed in this rack can be easily selected and picked up. The rack is attached to the back of the toolboard by angle irons

Tool for Turning Trunnions

H. M. JAMES
James Machine Works

In reconditioning the trunnions of universal drives of automatic vehicles, we add metal to the worn parts by electric welding and then turn them to correct size. Since the trunnions are integral with shafts from 4 to 6 ft. in length, it will readily be seen that they can not be swung in a lathe from their own centers.

Referring to the illustration, the steel sleeve *A* is held in the chuck and is closed at the inner end by a threaded plug. Backed by a stiff helical spring is a center *B* fitted in the sleeve and prevented from turning therein by the pin *C* engaging a lengthwise groove. The steel block *D* is welded to the sleeve and carries the turning tool. The depth of cut is regulated by the screw behind the tool and the tool is clamped by the screw *F*.



The tool revolves instead of the work. The cut is made by screwing out the tailstock spindle, moving the work past the tool and forcing the live center into the sleeve

In operation, the trunnions are held between centers, as shown, and the shaft rests against the front of the lathe bed. The work is fed to the tool by screwing out the tailstock spindle, forcing the live center into the sleeve against pressure of the spring. After one trunnion has been turned, the work is reversed to bring the other one into turning position. The tool is so shaped as to face the shoulders of the trunnions at the end of the longitudinal cut.

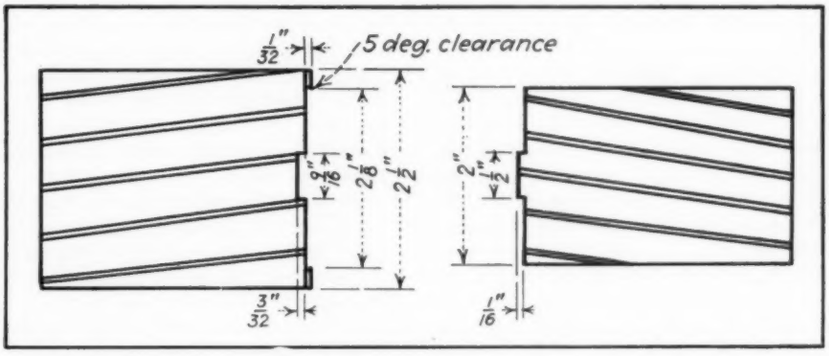
Improvised Interlocking Cutters for Stepped Work

HECTOR J. CHAMBERLAND

It sometimes happens that a gang of two cutters would expedite the milling of stepped work, but that the quantity of pieces to be milled would not warrant the purchase of suitable interlocking cutters. I have often overcome such obstacles by the means described.

After selecting two plain, helical cutters of approximately the correct diameters, they were ground to mill a step of the required height. A recess $\frac{1}{32}$ in. deep and $\frac{1}{8}$ in. larger in diameter than that of the smaller cutter is ground in one end of the larger cutter. The ends of the teeth in that end are given a 5-deg. clearance, otherwise they would drag on the vertical part of the step to be milled.

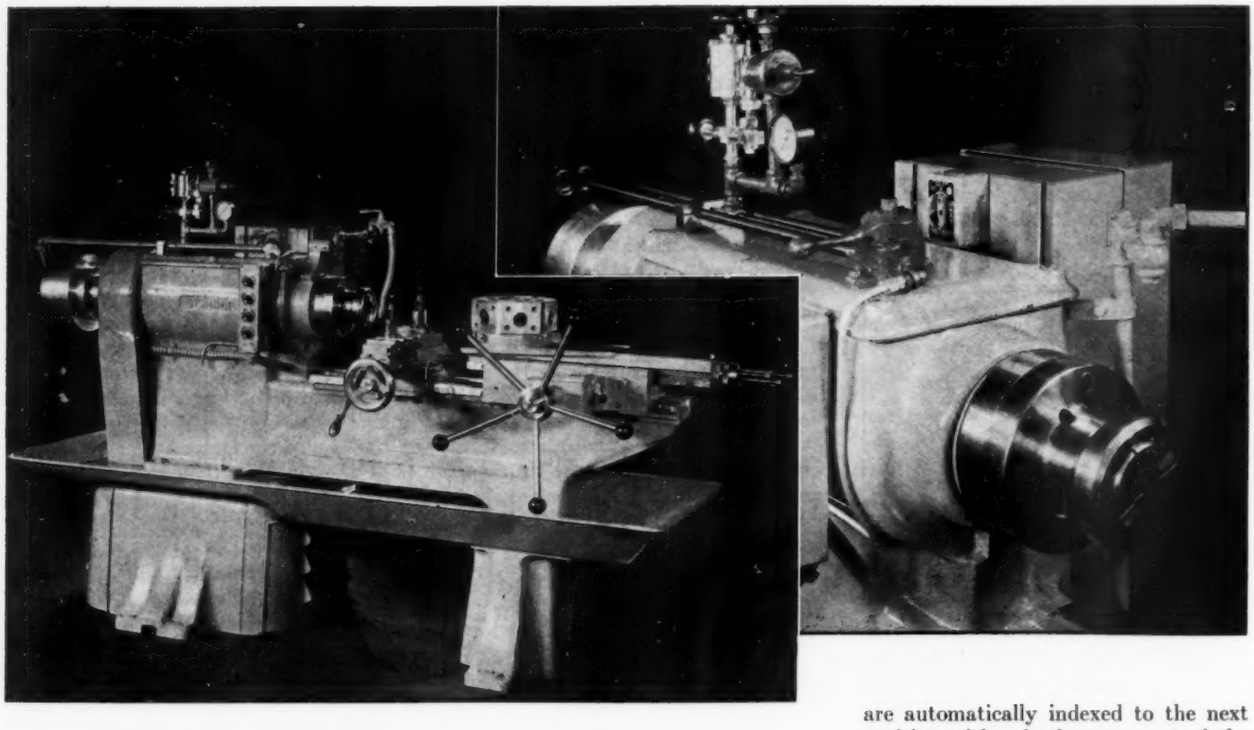
All that remains to be done is to grind a tang on one end of the smaller cutter and a mating slot in the end of the larger cutter, as shown in the illustration. The operation is performed in the surface grinder by locating the widths of the tang and the slot with a $\frac{1}{8}$-in. cutting-off of wheel and feeding to the required depth. The remaining stock can then be quickly removed with a straight-face wheel. Two cutters can thus be made interlocking and be put to work in less than one hour.



Two plain milling cutters can be made interlocking by grinding a recess in the end of the larger one and by grinding a slot and a mating tang on their facing ends

Shop Equipment NEWS

Left—Gisholt 18-in. high-speed, high-production turret lathe, showing pushbutton control. Below—gears and clutches have been omitted from spindle and headstock. Tapered roller-bearing spindle is driven by V-belts. Work-holding equipment of any desired type can be attached



Gisholt 18-in. High-Speed, High-Production Turret Lathe

A simplified, high-speed turret lathe for a wide range of both ferrous and non-ferrous material machining jobs has been announced by the Gisholt Machine Co., Madison, Wis. It is of the same general design as the company's Nos. 3, 4 and 5 universal turret lathes, and embodies many of the same automatic, labor-saving devices. The automatic collet chucking capacity for round, hexagon and square stock is 1½ in., 1⅜ in., and 1⅛ in., respectively, and uses either an 8-, 10- or 12-in. scroll chuck. The machine has a maximum of 18½ in. swing over the steel-topped ways.

Primarily designed for high-speed work, all gears and clutches have been omitted from the spindle and headstock. The spindle, mounted on tapered roller bearings, is driven by V-belts directly from the motor which is mounted in the cabinet under the headstock. These belts drive an aluminum sheave which is mounted on the spindle back of the rear bearing. This sheave is so mounted that it can be quickly removed and replaced by another of different diameter, varying the speed. A corresponding change is made in the motor pulley with an adjustment of the motor mounting to compensate for belt length.

Control of the spindle is by means of a pushbutton panel on the headstock, providing start, stop, reverse, and the various speeds of the motor. The hexagon turret and its stop roll are automatically indexed to the next position with a back movement of the slide. As the slide advances to the work, the turret is automatically located and clamped in place. The operator need not take his hand from the pilot wheel to accomplish this operation. The machine is offered with either a power or hand feed turret. The saddle may be clamped to the bed at any position suitable to the work at hand. The turret slide is surrounded by hardened steel bearing surfaces, i.e., hardened steel bed ways, clamps, tapered gibs and slide ways, all of which insure perfect alignment throughout long life.

Three different types of hand-operated cross-slides are offered and any one may be furnished with or without hand longitudinal adjustments to suit requirements. The three cross-slides are lever operated, screw operated or a combination of lever and screw operated. An undercut forming attachment may also be furnished for skiving tools for each cross-slide. All three

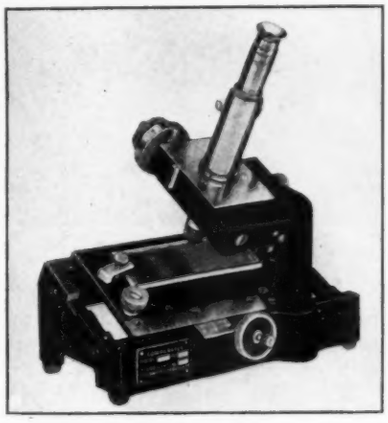
cross-slides are provided with adjustable stops and with T-slots.

The bed and headstock are integrally cast. The bed is composed of three heavily-walled box-sections, which are reinforced with eight sets of heavy X-side-ribs. Large internal fillets in the bed produce a cross-section similar to a tube, offering the greatest possible resistance to distortion. The beds are cast from nickel semi-steel in the Gisholt foundry.

The spindle bearings are automatically lubricated with filtered oil from an oil bath in the headstock well. The turret slide is equipped with a one-shot pressure oiling system, which forces oil through the saddle to the slide bearings. The oil is held in a reservoir which is entirely inclosed and kept clean, and this clean oil serves to flush the bearings. Work-holding equipment of any desired type may be readily attached to this machine.

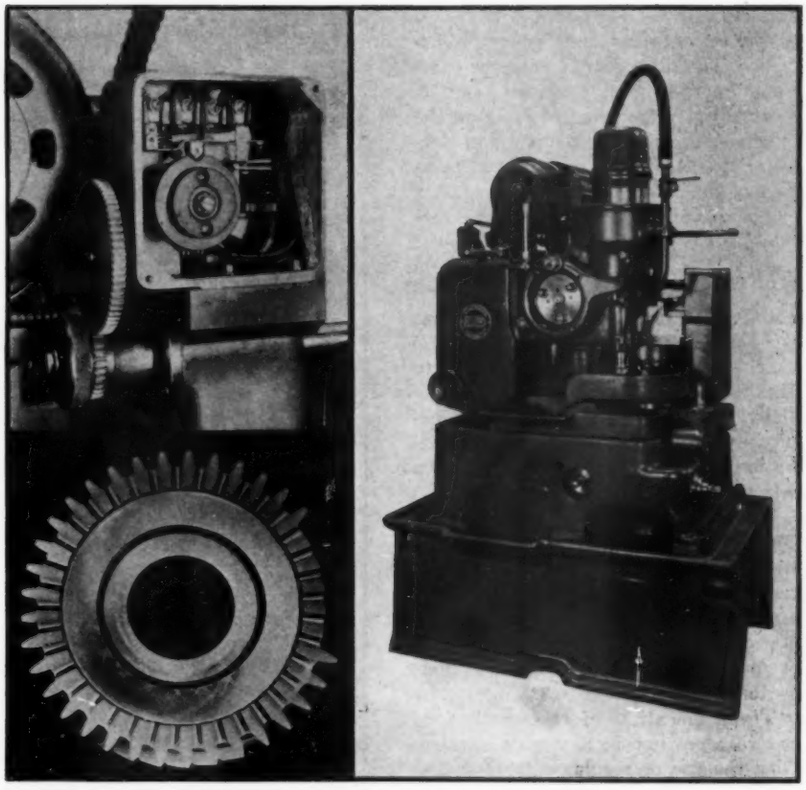
Stupakoff Comparator Microscope

A comparator microscope for accurately measuring small points on tools, dies and for inspection work, is announced by the Stupakoff Laboratories, 6625 Hamilton Ave., Pittsburgh, Pa. The miscroscope is 60-power, with



Small measurements and parts inspection can be made accurately with the Stupakoff comparator

adjustable eye lens for focussing sharply on the cross lines on the microscope field, and movable carriage on which the objects are fastened. The carriage moves 5 in. in one direction and 1 in. in the other. Measurements of opaque objects can be made. A 2-in. micrometer dial shows measurements in thousandths of an inch in one direction, and a vernier scale shows readings in hundredths of an inch in the other direction.



Right—Special Fellows Gear Shaper arranged for using gap-type roughing and finishing gear shaper cutters. Top Left—Close-up view of timing mechanism control for use with gap-type cutter. Lower Left—Gap-type cutter for roughing and finishing helical pinions in one operation

Fellows Gear Shaper For Gap-Type Cutting

A special gear shaper, designed to use the gap-type cutter, has been put on the market by the Fellows Gear Shaper Co., Springfield, Vt. This type of cutter is for rough and finish cutting of external spur and helical gears in one operation. The teeth on the circumference of the cutter are interrupted by one or more gaps, depending on the diameter and character of the work. The gap permits loading and unloading of the work without withdrawing the cutter from the work. The machine is arranged with motor drive and automatic electrical control to stop the machine when the gap in the cutter is located in the most convenient position to remove and insert the work.

This gap-type cutter differs from the regular gear shaper cutter in the following respects: (1) a single cutter is used for both roughing and finishing, the cutting being done by separate sets of teeth; (2) the cutter is made with a multiple of the number of teeth on the work; (3) the cutter is held in a fixed position during the roughing and finishing cuts; and (4) the cutter is rotated into depth, instead of being fed in radially.

The gap-type cutter is made with several arrangements of the cutting teeth. The cutter shown is used for cutting a 16-tooth helical pinion, and is made with two sets of teeth: one roughing; the other finishing. The roughing teeth are made shorter and thinner than the finishing teeth. In this case the work makes two revolutions to one revolution of the cutter and completes the gear in one operation.

The machine differs from the regular gear shaper in that it is arranged with electrical control for timing the rotation of the cutter-spindle. The close-up view shows the timing mechanism with cover plate removed to expose the operating mechanism. It will be

noticed that the limit switch is geared to the upper worm-shaft and is driven by it. The ratio gears rotate the cams that operate the electrical control mechanism. One cam acts to stop the machine, and the other sets up an electrical circuit preparatory to the operation of the "stop" cam.

The driving gears must have a direct relation to the number of gaps in the cutter. For a one-gap cutter the ratio is 2 to 1; and 1 to 1 for a two-gap cutter. Production is increased about one-third.

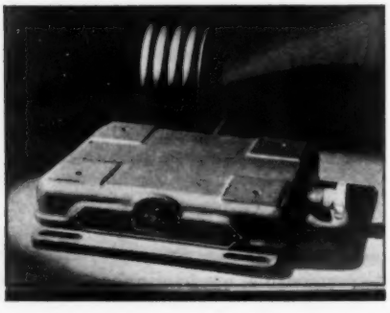
In some cases it is also possible to obtain greater accuracy. This is especially so in the cutting of small fine-pitch pinions, due to a better distribution of the cutting between various sets of cutting teeth.

The electrical equipment comprises a constant-speed motor; motor starter with thermal overload protection; interlocking contactors of the "make" and "break" type; push button control station; automatic stop for use with regular cutters; and cam-operated limit switch.

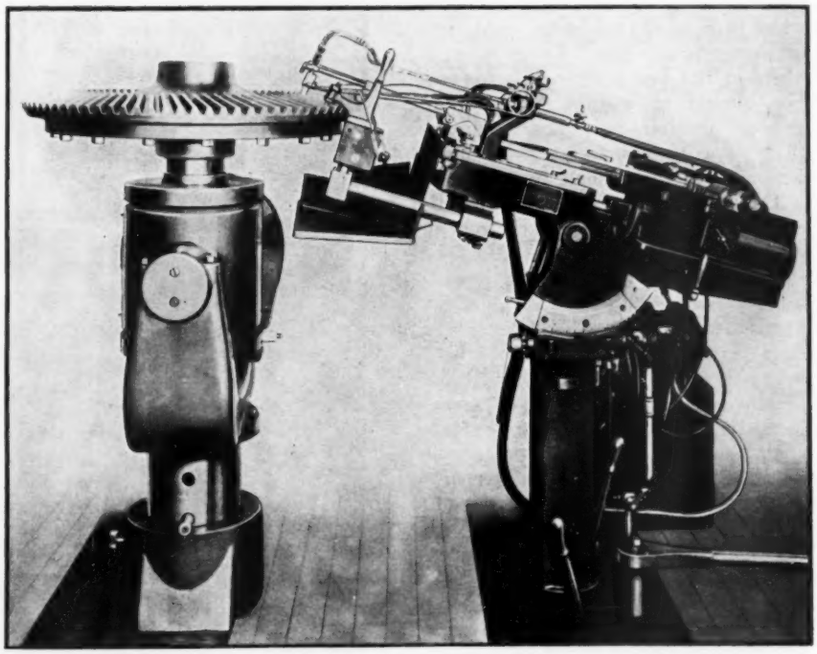
The application of this method of control does not in any way interfere with the use of regular cutters on the machine. When regular cutters are used, the limit switch is rendered inoperative by removing the driving gear on the upper worm shaft and setting the automatic stop control to stop the machine. Maximum capacity is about 2½ inches pitch diameter, 6/8 diametral pitch.

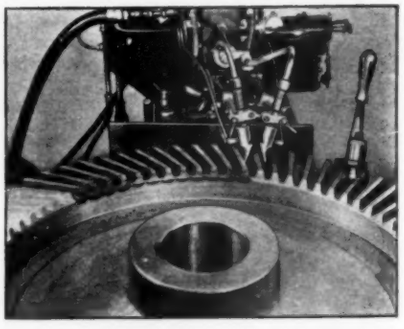
"Straitline" Automatic Motor Base

The "Straitline" automatic ball-bearing motor base developed by Allis-Chalmers Mfg. Co., West Allis, Milwaukee, Wis., provides a convenient place from which to operate the company's "Vari-Pitch" sheave. The unit maintains a uniform belt tension throughout the speed-range adjustment. Its dial indicator shows the tension of the V-belts, permitting belt tension control, assuring maximum life.



Gleason Surface Hardening Machine for Large Bevel Gears





Upper left—Gleason surface hardening machine for large bevel gears. Right—Showing how the oxyacetylene burners can be adjusted at any desired angle to heat gear teeth. Quenching is by water jets behind the burners

Opening the field for accurate and uniform surface hardening with an oxyacetylene flame, the Gleason Works, 1000 University Ave., Rochester, N. Y., offers a universal machine to surface-harden large bevel gear teeth. Pitches from 5 P. D. and diameters up to 100, inclusive, can be taken by the machine. No measurable distortion has been found in gears hardened by this process, both the teeth and the body of the gear showing no change upon careful checking before and after hardening.

The machine hardens both sides of a tooth simultaneously, precluding the danger of drawing or checking opposite sides, as is the case when only one side of the tooth is hardened at a time. Two small water streams directly back of the burners, quench the gears, no cumbersome tanks being required. Except for manual indexing, the operation is entirely automatic. The hydraulic control is flexible and permits variable speed of travel so that uniform heating of a section of tapering thickness and speeding up at both ends to prevent overheating of the corners of the teeth are possible. Five pairs of burners, covering almost any gear requirement, are furnished with each machine.

A wearing surface equal to case-hardening can be obtained, Rockwell 55-60, Scleroscope 65-70. Penetration can be varied to almost any desired amount by adjusting the speed of travel. The work spindle unit is universal. It swings on trunnions through a 90-deg. arc. Spacers are provided for adjusting to a convenient working height. The burner upright is raised and lowered hydraulically. The burner unit has an angular adjustment, to fit the demands of any angle of teeth.

The steel recommended for treatment in the machine is a casting or forging type of 1.25 per cent manganese and 0.35 carbon, or SAE 6145 for even greater strength.

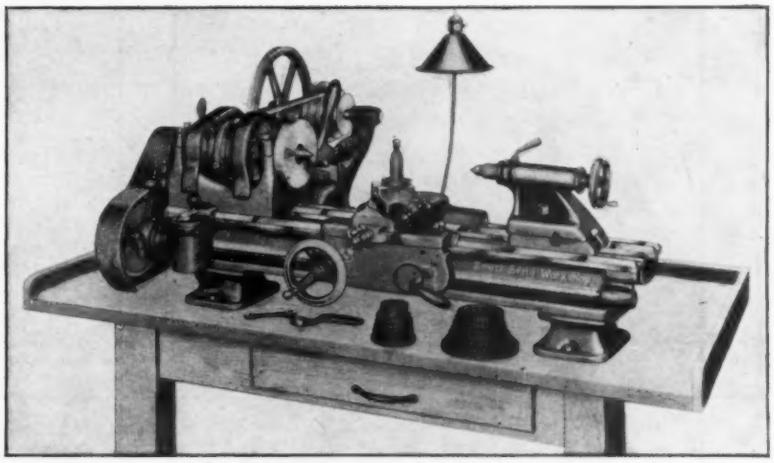
Jefferson Transformers for Mercury Lamps

A line of four styles of transformers and reactors for mercury-vapor lamps has been developed by the Jefferson Electric Co., Bellwood, Ill. Types to be mounted on walls, for suspension and fixtures indoors, and weatherproof types for outdoor use are included in the line. The wall type is a snap-on,

self-locking device with plug and jack connections for quick change of primary tap to match the voltage of the power line. The change from one primary tap to another is accomplished quickly without the aid of tools.

Westinghouse Fan-Cooled Inclosed D.C. Motor

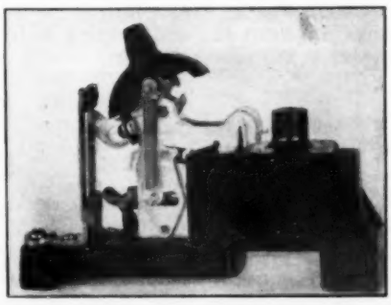
A fan-cooled, totally inclosed d.c. motor with unusual accessibility to the armature has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. It has an external fan and shroud on the commutator end. Because the blower is on the commutator end and not the pinion end, the motor can be mounted snugly against a gear case or other wall. This design prevents the blower from sucking lubricating oil from the gear case and spreading it over the motor frame and brackets. The blower is made of cast aluminum with a split hub and keyed to the shaft. Two bolts draw the hub down tighly.



South Bend 9-in. "Workshop" Lathe equipped with V-belt drive. The 8 spindle speeds are from 44 to 585 r.p.m.

General Electric Air Circuit Breaker

Type AF-1 air circuit breaker of General Electric Co., which replaces fuses and protects industrial circuits, has been redesigned to provide a mid-position of the handle to indicate automatic tripping. When tripped, the handle now assumes a position between the "on" and "off" points, solving the problem of inspection when the breaker is mounted in an inclosed case. The breaker is easily reclosed by moving the handle to the extreme "off" position. The design is available for 230-volt a.c., 125-250-volt d.c., 50-amp. use. The improved model features easier operation.



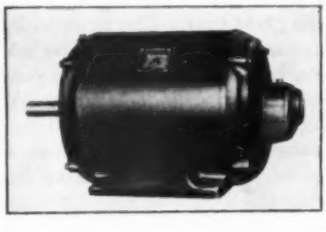
Redesigned General Electric AF-1 air circuit breaker, shown in reset for closing

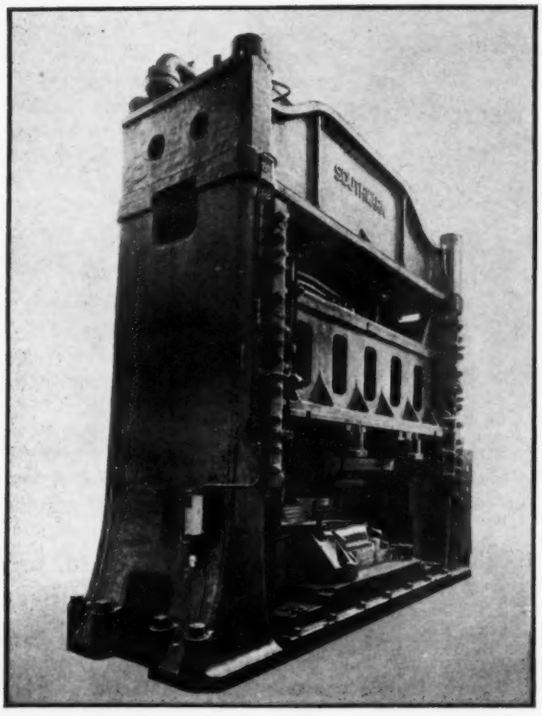
"Workshop" 9-In. Lathe With V-Belt Drive

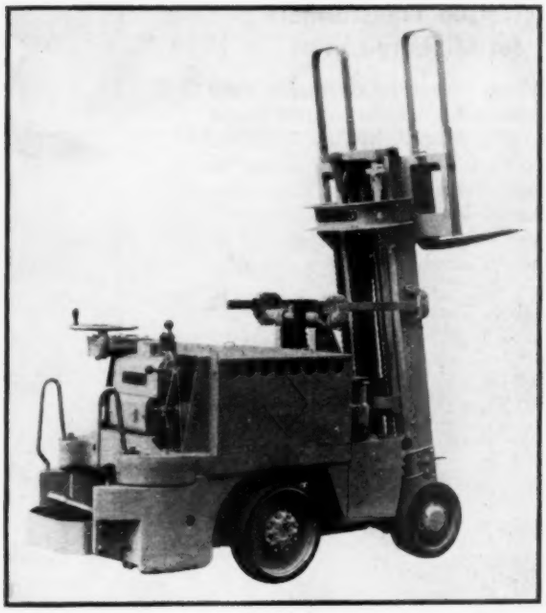
A V-belt drive is now optional on the 1936 Model, 9-in. "Workshop" precision lathe manufactured by the South Bend Lathe Works, South Bend, Ind. It has a four-step cone headstock, with a single V-belt drive from the countershaft. This provides eight spindle speeds, four on open belt and four in backgear. The speeds range from 44 to 585 r.p.m. The countershaft is equipped with a four-step V-pulley for single V-belt motor drive, which is used with the adjustable type of countershaft. Bed lengths of 3, 3½, 4, and 4½ ft. are available in this model.

Emerson SR Type Single-Phase Motor

A single-phase motor embodying a smooth torque-speed curve, efficient starting features of the repulsion motor, and the approximately constant-speed load operation of the induction motor, has been developed by the Emerson Electric Mfg. Co., Inc., 2088 Washington Ave., St. Louis, Mo. These motors, known as the SR Type, are made in 1, 1½ and 3 hp. ratings. The motor has an armature with both a squirrel-cage and a repulsion, or commuted, type of winding. Both windings operate as such at all times.







Left—Baldwin-Southwark 830-ton press built for Ford Motor Australian plant. Above—Elwell-Parker 6,000 lb. fork truck for handling skids and pallets

Baldwin-Southwark 830-Ton Press

Baldwin-Southwark Corp., Eddystone, Philadelphia, Pa., has shipped to the Ford Motor plant at Geelong, Australia, an 830-ton triple-acting hydraulic press. The machine uses direct-acting hydraulic cylinders, a relatively new development in such equipment.

The press has a clear distance of 132 in. between guides, and the maximum "daylight" is 72 in. Four screw stops on the outer slide of this press allow a varying amount of clamping pressure to be applied at each of the four corners. It has four 26-in. stroke cylinders, yielding 230 tons. The inner slide has a horn-type guide to take eccentric loading. The guide for the inner slide has an equivalent length of 144 in.

This unusual construction gives a guide length more than equal to the width of the slide. The adjustable bronze gibs are mounted on a rocking backing piece to assure full bearing of the gibs. The two draw cylinders in this inner slide produce a pressure totaling 600 tons. The inner slide has a working stroke of 42 in. The bottom action has a 12-in. stroke. It consists of a push-up cylinder and two main cylinders of 480-ton total. This can be used as a third action, or as a die cushion. An automatic valve in the line to the cylinders which return the slides to their upper positions prevents the slides from dropping in case of motor or other failure.

Elwell-Parker 6,000-Lb. Fork Truck

A heavy-duty, electric fork truck has been developed by the Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio, for lifting, carrying and lowering loads of 6,000 lb. It develops traveling speed of 525 ft. per min. Dynamic brakes on the drive motor electrically control the descending load. Forks, for handling skids or pallets, are built to specification according to the nature of the work to be done. When tiering, loading forks can be hoisted at the speed of 15 ft. per min., and lowered at a 28-ft. rate. Regenerative braking on the hoist when lowering generates energy to the battery. Drive tires are 22x6 in., and steering is by wheel at the operator's left.

Niagara Series A Inclinable Press

The Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, N. Y., announces a "Master Series A" inclinable press with a 1¼-in. shaft, for use in manufacturing light metal stampings. The press is equipped with the Niagara 14-point engagement sleeve clutch, providing safety, maximum strokes per minute and long life. Flywheel and throwout spindle are mounted on anti-friction bearings. The sleeve clutch is equipped with positive stop, locking device and single-stroke mechanism. The slide operates in adjustable double V-gibs, and has equal support for the die from the center to front and center to rear. Breech-block die clamp gives solid support to die under pressure. The press is so designed that there is practically no change in bed height when inclined.

Light, inclinable press for small stampings

Pease Model 7 Blue-Print Machine

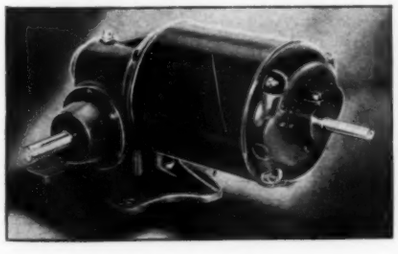
Model 7 continuous printer for making blue-prints has been announced by the C. F. Pease Co., 813 North Franklin St., Chicago, Ill. It was developed for continuous printing of moderate requirements, and for auxiliary equipment to be used with machines of larger capacities because it is well adapted for handling rush jobs. It is of the horizontal type. Tracings and sensitized paper are fed into the machine from the front and onto an endless fabric band which carries them upward, around and through the machine in close contact with the curved section of highly polished plate glass where the exposure takes place. After the exposure has been made, the tracings and the paper are returned into

the tray at the front of the machine.

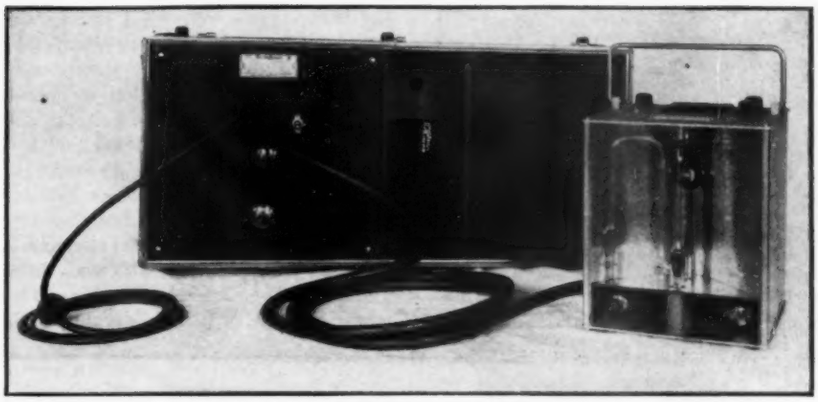
The speed range is from 4 to 60 in. per min. The machine is 54 in. high, 61 in. wide, 32 in. deep, and takes 32 x 61 in. floor space.

Wagner Slow-Speed Gear Motors

Fractional-horsepower gear motors, to deliver power at any required speed, have been developed by Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo. They are available in single-reduction and double-reduction types with right-angle-shaft drive; and in single-, double- or triple-reduction



types with parallel-shaft drive. The speed range is as low as 6 r.p.m. A phosphor-bronze worm gear is driven by a heat-treated nickel-alloy steel worm. The low-speed output shaft is supported on two roller bearings.



Westinghouse PSE-2 "Stroboglow" which produces bright stroboscopic images with a range from 100 to 5,000 flashes per min.

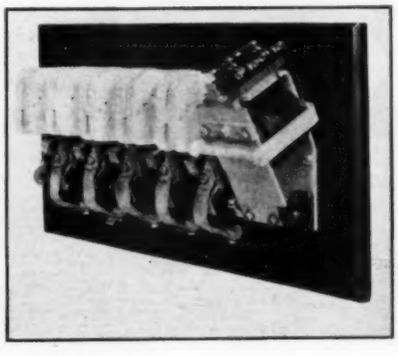
Westinghouse "Stroboglow" Portable Stroboscope

A portable "Stroboglow" producing brighter stroboscopic images than heretofore attained is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. It develops momentary illumination of 300,000 cp. The instrument is designed to analyze any periodic movement from 100 to 30,000 cycles per min., such as vibration of rotating and reciprocating apparatus, as well as for sequence analysis of mechanisms which have motions of a recurrent nature, such as sewing machines, moving-picture cameras and projectors, and machine guns.

The "Stroboglow" consists of a power unit and a lamp mounted in a compact case. The lamp unit is removed from the case when the instrument is in use, and is connected to the power unit by a heavy-duty cable 10 ft. long. The grid and plate voltages of the power unit are rectified by two No. 83 tubes and filtered. The unit operates from a 115-v., 50-60 cycle a.c. line. Net weight, 55 lb.

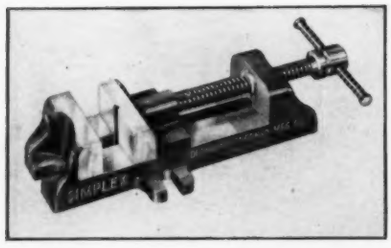
General Electric Low-Voltage Contactor

A low-voltage a.c. contactor, which will stay closed under voltage disturbances or failure, has been announced by the General Electric Co., Schenectady, N. Y. Instead of using a mechanical latching mechanism the contactor is closed by a d.c. magnet, energized through a copper-oxide rectifier. It is held closed by the attraction of a permanently magnetized core, and the movable armature. The magnet is made of the alloy "Alnico," which retains its magnetism indefinitely. A reversal of the coil-exciting current with a push button momentarily opens the contactor. It is free from coil hum, and has no coil losses while closed.



"Simplex" Machine Tool Vise

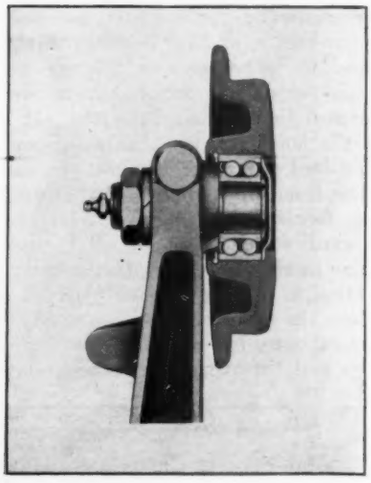
A light-weight vise, designed for use with drill presses and milling machines, has been announced by the Desmond—Stephan Mfg. Co., Urbana, Ohio. This "Simplex" vise has a jaw width of 3½ in., and a jaw opening of 4½ in. It has T-slots both ways in the bottom, and a bronze removable nut in which the screw turns. A V-slot is cut in the movable jaw for holding round



pieces of work. The top, sides and faces of the jaws are accurately machined, as are the top and bottom of the base. Four slots are provided for bolting the vise to the work table. It weighs 15 lb.

Osborn Tramrail Trolley Wheel

An improved trolley wheel for Osborn Tramrail systems has been announced by the Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio. The wheel is made of a high strength, cast iron with a deep-chilled tread and flange, providing a hard, smooth, long-wearing surface. A slight crown of the wheel tread brings the wear on the rail flange in from the outside. The straight flanges of the wheel reduces



rolling friction to a minimum. The double-row, shielded ball bearing is assembled by the bearing manufacturer to assure accuracy. The dust-protected bearing is grease lubricated and the assembly may be cleaned.

Milburn MM Paint Spray Gun

Type MM paint spray gun has been announced by the Alexander Milburn Co., 1436 West Baltimore St., Baltimore, Md. The gun is balanced like a pistol. Paint coverage and shape are controlled by turning two knurled nuts. Cleaning takes only a few seconds because parts touched by paint are in the single unit, detachable spray head. The air-hose connection, located at the base of the handle, is designed for ease of handling and prevents tangling or obstructing the adjustment controls.

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General Electric Mercury-Vapor Incandescent Lamp

Color characteristics of both the mercury vapor and incandescent lamps are combined in a self-contained "daylight" lighting unit brought out by the General Electric Vapor Lamp Co., Hoboken, N. J. The high blue and green of the mercury vapor source are blended with the red of the incandescent and make for the best visual characteristics wherever actual color perception is an important factor in shop operation. Furthermore, the full light value of both the tube and the lamp are utilized in the new unit. The regular unit with a 33-in. mercury tube and a 200-watt incandescent lamp operates at 500 watts and delivers a red-blue-green light which closely approximates afternoon sun. Tube and lamp are easily removable for cleaning, and the unit is easily installed.

General Electric mercury-incandescent lamp combines advantages of both light sources

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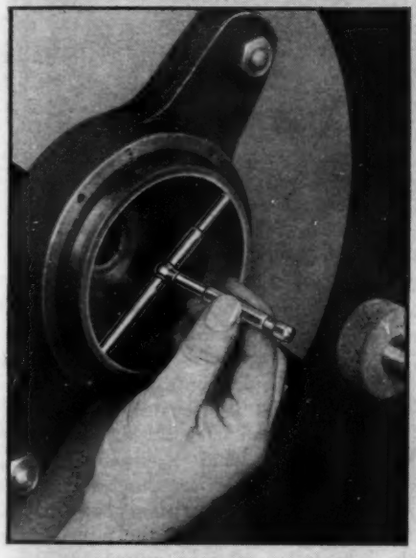
TELESCOPING GAGE

No. 79



Five Ranges:

½ to ¾ in.
¾ to 1¼ in.
1¼ to 2⅛ in.
2⅛ to 3½ in.
3½ to 6 in.

Note position of handle in illustration showing the Telescoping Gage in use on blanking die.

Even though Gage is not fully extended, the handle is *"Just where it should be,"* in the center of the tool.

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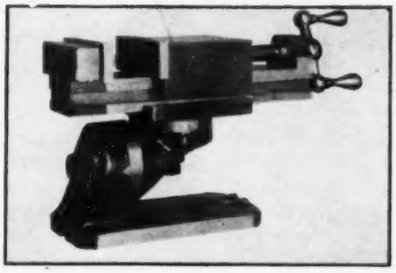
Strand Flexible-Shaft Machines

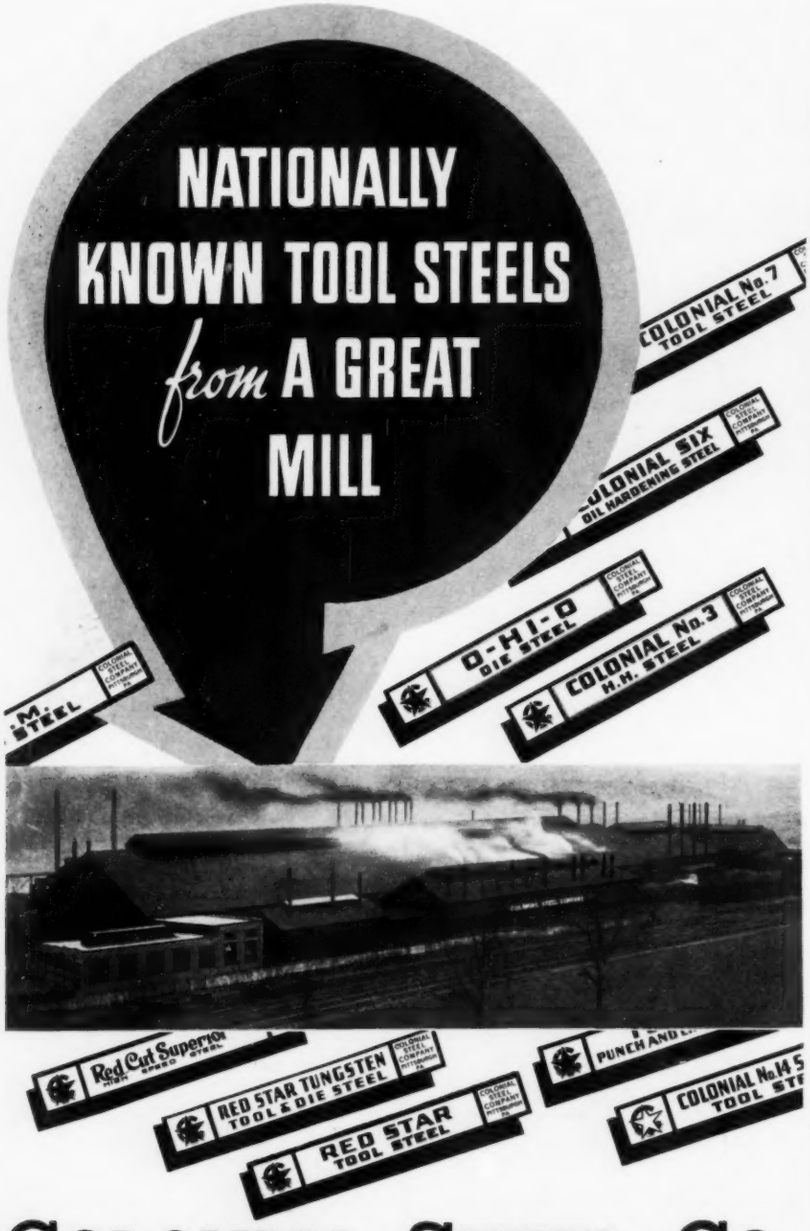
A line of vertical-type, three-speed, flexible-shaft machines has been added by the N. A. Strand Co., 5001 North Lincoln St., Chicago, Ill. This type is made in ⅛-, ¼- and ⅓-hp. capacities, although larger units will be furnished. Speeds of 1,700, 3,000 and 5,200 r.p.m. or of 3,400, 6,000 and 10,400 r.p.m. are provided. The machines are full ball bearing; the three-speed

countershaft is conveniently located for quick change-over. Each machine is mounted in a swivel bail and is provided with adjustable tie-rod for suspending.

Covel Universal Machine Vise

A 4-in. universal vise for surface grinders, milling machines, shapers or drill presses has been announced by Covel Mfg. Co., Benton Harbor, Mich. Predetermined angles and clearances in both directions can be produced accurately. The top part of the vise is fastened to a universal bracket with a T-slot bolt, and the top may be turned around or removed entirely. All surfaces are ground to squareness and graduated in degrees. Jaws are 4½ in. wide and 1½ in. high. The base dimensions are 4½x8 in. Weight, 36 lb.

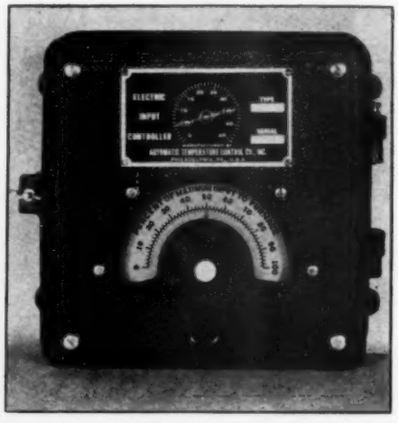




COLONIAL STEEL CO.
PITTSBURGH, PA.

"Automatic" Temperature Controllers

A line of current-input controllers for electric furnaces, ovens and other heating units has been developed by the Automatic Temperature Control Co., Inc., 34 East Logan St., Philadelphia, Pa. The controllers have been designed to hold temperatures of heating units closer to the desired temperature curve to meet the more exacting requirements of the today's heat-treating standards. Four standard models have been produced to meet various requirements.



Model M is designed to prevent a constant load from arising in the temperature beyond a desired setting; Model MT exercises this same control, and is provided with a built-in time control which brings the input-control into action after an adjustable period; Model F and FL are for controlling variable loads.

Grinding Scores Again

Surely, but not slowly, grinding is making its way as a finishing operation. One of the latest achievements is the grinding of teeth of spiral-bevel ring gears for automobiles. While this is not absolutely new, it is just becoming a commercial production operation. A machine for doing this was developed several years ago, but it never got beyond the stage of salvaging gears that would otherwise have had to be scrapped. The new machine is taking its place in the production line of at least one large auto plant.